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The Institute of Vitreous Enamellers

The Welsh Engineers' and Founders' Association

and

The Foundry Trades' Equipment and Supplies Association

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Business Prospects for 1938

We refrained from dealing with the business prospects for this year in our Annual Review Number last week, as we were aware that data from other industries which have their influence on the foundry trade would only be available for consideration last week-end. The answers to a questionnaire which we sent out were filled in before these statistics became available, and were influenced by the state of the order-books before Christmas. An analysis of these figures shows that, of a representative body of members of the foundry industry, 13 per cent. believed the prospects to be excellent, 69 per cent. thought they were good, 17 per cent. deemed they were medium, and 4 per cent. were pessimistic. Obviously general opinion is that industry will be decidedly good, with some recession in certain sections. The departments which can rely on good trade are those connected with the heavy industries. The natural repercussion is that railways, mines, and engineering should benefit. It means, too, that money is going into areas where it has been short for a long period, and these communities will spend their wages on refurnishing their homes, and buying such commodities as motor-cycles, radio apparatus, and the thousand and one articles which help to keep the lighter industries busy. There has been a slackening-off in trade, due to two main factors: (1) Stock Exchange nervousness entirely attributable to foreign influences, and (2) a tendency on the part of the women to save rather than spend. No doubt this is because the scare Press takes figures and items of news from their proper context and makes them assume an importance they do not often possess. Foreign affairs are in a poor state, but most of the nations are fundamentally pacific, as the memory of the last war is still fresh in their memories. Factors worthy of consideration in this sphere are: (1) the waning of the earlier enthusiasm for the newer political creeds; (2) a general desire for easing the conditions for the conduct of international trade; (3) the incalculable outcome of hostilities waged between major powers, and (4) the rapidly increasing strength of the British rearmament position. The proposed Anglo-American commercial treaty will need to be carefully negotiated, as it is the easiest thing imaginable thereby to injure the interests of the Dominions and our own agricultural industry. The lines it takes will be of major interest to the foundry industry. A number of commodities previously taken from the United States are being manufactured successfully in this country in growing quantities, and machine tools and typewriters typify such cases.

Our final thought on trade conditions is, major upheavals excepted, that business will continue on a slightly lower level than that of 1937, but will still be definitely "good."

The Tower of Babel—III

We have surveyed the problems arising from the creation of foundry information and the conduct of foundry research and development in countries previously unaccustomed to such work, through the variety of languages now employed. Partly because much of this work consists in confirming and interpreting to their own nationals matter published elsewhere first, and partly because some of it is apt to be of a highly theoretical and even speculative character, it should be made available to British readers through some agency capable of looking at it critically and of relating it to the general body of existing knowledge. We can conclude with a reference to the growth of the industry in the Empire. Canada, Australia, New Zealand, South Africa and India and even Newfoundland can claim to have an active foundry industry, and various media exist through which those concerned can interchange ideas. Here again are sources of original material for abstractors of foundry data. Translation is not necessary, although it is often necessary to bear in mind differences in outlook and product. This also applies in a larger degree to work carried out in America, which produces data of the most valuable kind for the industry. Differences in units, terms and in modes of expression have to be allowed for. This combination of work expressed in English from this country, the States and the Dominions makes English one of the three great languages for abstracting purposes, and in which summaries of Papers at international conferences are published. French, the traditional language of diplomatic interchange and spoken by many nations of Latin origin, is the second, and German the third, justifying its place both by the value and volume of original work published in it. To a scientist German is undoubtedly the most important language next to his own. To secure the greatest advantage at minimum trouble and cost from the many publications in so many tongues is a problem which challenges the most intelligent men, though in this direction the foundry industry is well served by its technical Press, both at home and abroad.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Custom of the Trade

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—The difficulty in which your correspondent, "Inquirer," finds himself relative to the order he placed for the machining of his alloy castings may be eased, if he has given all the facts which governed the contract.

It could not be sustained that the custom of any engineering trade exonerated a party from responsibility for negligent work, which appears to describe the present case. As the machinists in question have withdrawn their charge for the work, they have, presumably, admitted their workmanship at fault. If the wrong machining had resulted from a hazard to which machining was subject, then a proved usage of the trade covering such hazard in favour of the machinists would have been a complete answer to "Inquirer's" claim for the value of the castings. According to your correspondent, the machinists were informed the castings were of special alloy material, so it was their responsibility to ascertain whether their machine tools were sufficiently rigid and equipped to cut the material to the required dimensions with wonted precision. No suggestion has been made of faulty castings. On these facts it is abundantly clear that the machinists are liable for the value of the material they have spoilt.

The only trade usage relating to the machining of other people's castings which the writer has heard suggested is that, where machining reveals a faulty casting, the machinist is entitled to charge for work done upon the casting prior to the fault being discovered. Actually, this is not a trade custom but well-established law.—Yours, etc.,

"FOUNDRYIST."

January 10, 1938.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—With reference to "Inquirer's" letter in your issue of January 6, it is, in my experience, the universal custom of the trade not to accept liability except for the specific work undertaken.

To amplify this, the founder making castings undertakes only to supply good castings, and takes no liability for any machining costs, should the castings prove faulty. He will replace faulty castings or credit them, at his option.

Similarly, a firm undertaking machining operations admits liability to perform satisfactorily the machining, but does not accept liability to the owner for any of the parts sent in for machining should he scrap the parts through his machining proving faulty. Should his machining prove faulty he will remachine free of charge fresh castings or other parts sent to him, or make no charge for the work done.

Such trade practices are obviously quite equitable and, I believe, have been upheld in the Courts, on the grounds that no founder or engineer can be asked to undertake liability greater than the reward he gets for his work. As is obvious, a founder might get 10s. for a casting which costs £10 to machine; also, a firm undertaking machining only might get 10s. for a casting which cost £10 to produce, and if either were to be held responsible for the cost of the casting or the machining, business would be impossible. "Inquirer's" loss is unfortunate, but is more or less an everyday occurrence in engineering and allied trades. It falls under the category of consequential liability, which no one in their right senses would accept.—Yours, etc.,

"ENGINEER."

January 17, 1938.

Belt Conveyor Speeds

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—In a recent favourable review of my book on "Conveying Machinery," your reviewer, P. F. A., took exception to the belt speeds instanced in the section on belt conveyors, viz., 300 and 500 ft. per min., the latter being about double the speed that he regarded as an economic maximum.

Although the belt conveyor is well adapted to run at a high speed, the actual speeds of belts vary enormously according to the purpose for which they are used, as for handling grain, sand, coal and ores.

For durability a relatively wide belt run at a moderate speed is undoubtedly to be preferred to a narrow belt run at a high speed, despite the higher first cost.

The 36-in. flat belt described on page 13, at a parcel post office, runs at 120 ft. per min. as stated, while the 24-in. steel belt for sand cores referred to on page 163 runs at the slow speed of 10 ft. per min. Moreover, the 18-in. shuttle belt conveyor for coal shown in the frontispiece runs at 300 ft. per min.

Turning to American practice, F. V. Hetzel says that in modern practice wheat and corn are carried at speeds up to 800 ft. per min. on belts 36-in. and wider, but on belts less than 20 in. wide the speed should be less than 500 ft. per min.

The same authority says that the maximum advisable speeds for coal, ore and gravel conveyors are 300 for a 12-in. belt, 400 for a 24-in. belt and 600 ft. per min. for a 48-in. belt. I agree that slower speeds than these are often economically advisable, especially when the belt is inclined.—Yours, etc.,

W. H. ATHERTON.

Ewart Chainbelt Company, Limited,
Derby.
January 4, 1938.

Technical Translations

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I read with great interest the leader entitled "The Tower of Babel" which appeared in THE FOUNDRY TRADE JOURNAL of December 23, 1937. I seem to remember "Marksman" making a reference, a few months ago, to the language difficulties at the international meetings of foundrymen.

In the circumstances, I put forward the following suggestion as one which may appeal to you, and which I feel sure would provide a solution of the problems arising from the publication of Papers on foundry research and foundry practice in a multiplicity of languages.

This suggestion is that all such treatises should be written in two languages only—firstly, in the mother tongue of the author and, secondly, in the international language Esperanto.

In this way the information could be circulated immediately to interested parties in all countries without the tedious labour of simultaneous translations into several languages. With only one translation the risk of misunderstanding would be minimised.

If this suggestion were adopted, I imagine that many of the problems set out in the second paragraph of your leader would solve themselves. It does not seem necessary at this stage to go into details which could be worked out by the national and international organisations of the trade. Should the matter appear worthy of your further investigation, I would be happy to assist to the best of my ability, unless you would prefer to consult the British Esperanto Association, 142, High Holborn, London, W.C.1, or the Internacia Esperanto Ligo, Esperanto House, Heronsgate, Rickmansworth, Herts.—Yours, etc.,

R. MURRAY.

"Dunrobin," Northumberland Crescent,
Thorpe Bay, Essex.
January 11, 1938.

Random Shots

Professor Gierdziejewski, in the sumptuously fat Annual Review number which the Editor and his satellites published last week, extended an extremely cordial welcome to Poland in September of this year on the occasion of the International Foundry Congress. One explores with him in imagination the delights of Warsaw, steeps oneself in the antiquity of Krakow, whilst one's fancy climbs the giddy heights of the Tatra mountains, only to waken up with a start to remember that it is still only January, and these delights cannot materialise for many long months. Even when that time comes inclination and desire must win a decisive battle against time and bank balance [lack of, in both cases!]. Having recently "read up" Poland, "Marksman" would like to help Professor Gierdziejewski to prime inclination and desire for the fray, and to add a few hints which may possibly be appreciated by those to whom Poland will be new territory. It is useful to know, for instance, that soda water can be obtained from automatic machines in the streets of Warsaw, as much as one can drink for 5 groszy a time. It might help the Scottish visitor to decide how much whiskey to carry about his person. A word of warning is necessary here, however, for to walk diagonally across the street makes one liable to a fine of one zloty, cash down, and that would be a pity, for too many fines would run away with zlotys earmarked for vodka. One can also be fined one zloty for throwing paper down in the street, and so it would be well to be forearmed with a case in which to carry about conference papers!

* * *

He who is brave enough to indulge in a little private travelling whilst in Poland should allow plenty of time to get his railway ticket, for it seems that scarcely anyone pays the regular fare, and the booking clerk has to make many complicated calculations for every customer; and, of course, there should be some good reason, too, for the English visitor to travel at a reduced rate! Apparently no one is ever in a hurry to keep an appointment at the exact time. This will have a special appeal for those who dread that "buses at the hotel door at 9 a.m." order which is the one snag of all conferences!

* * *

Last Friday the Refractories Association of Great Britain once again sent the merry notes of festivity running through the rooms of the Hotel Victoria in Sheffield. One can always depend on some entirely novel setting for the occasion, but this time they set their capers to the tune of a sailor's horn-pipe as it were, and had a real "naughtical" evening. If the number of berths was really limited to 250 then there must have been a goodly number of stowaways, who nevertheless did not stow away anything but a rattling good dinner along with the other passengers. A set of Customs officers made themselves responsible for much of the organisation of the fun during the evening, with great success, and this was odd because one usually associates Customs officers with a general state of disorganisation, be it bags, nerves, temper, or conscience.

* * *

Touches of realism were provided by a ship's bell and other sea-trip gear, by the representation of the reception room as a ship's deck, lifebelts, and even passports. Amongst such a long list of distinguished passengers it would be difficult to mention a few without making the others jealous. Suffice it to say that most of the faces seemed very familiar and they certainly became more familiar as the evening wore on, or, in the case of the ladies, the make-up wore off.

"MARKSMAN."

Testing of Moulding Sands

At the December meeting of the Bristol section of the Institute of British Foundrymen, Mr. N. D. Ridsdale, of Middlesbrough, a member of the Institute's Sands Committee, gave a lecture on the subject of "The Testing of Foundry Sands."

The author reviewed the purpose of sand testing and attempted to answer the natural question of the average foundryman, "Will it help me to make better and cheaper castings and to increase production?" The speaker pointed out that routine foundry sand testing did not seek to belittle the experience gained by moulders, but rather to enable their experience to be translated into terms and figures so that the principal properties of sands could be reproduced and compared as simply and readily as possible. He then gave a few practical illustrations of how sand testing had in his experience been of value in the foundry, and then proceeded to enumerate the principal routine tests for controlling the chief physical properties of green sand, dry sand and oil sands.

FIG. 1.—MOISTURE TELLER.

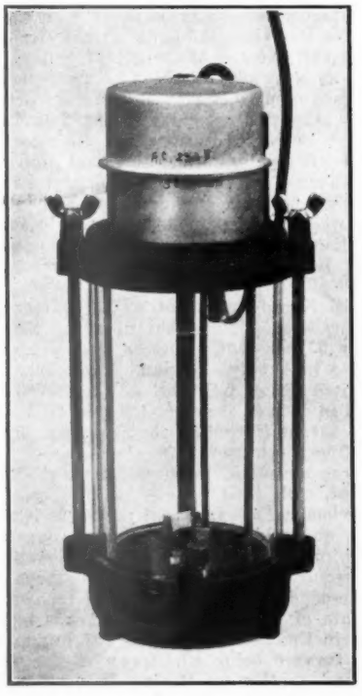


FIG. 3.—RAPID SAND WASHER.

Moisture Content

In dealing with rapid moisture determinations he illustrated the Dietert design of Moisture Teller shown in Fig. 1, and explained that it would dry a large 50 gramme sample in 45 seconds by means of a rapid stream of electrically-heated air at 230 deg. Fah. (110 deg. C.). The moisture determinations by this instrument, he said, were remarkably accurate, and the weighing was greatly simplified by a special sturdy balance having sliding weights on the beam to enable the moisture percentage to be read off in a simple manner. No corrections or calibrations were required, and each test could be completed in about 2 or 3 minutes. The instrument could be used for many materials other than moulding sand, such as ganister, coke, etc. Fortunately, the instrument was now being manufactured in this country by arrangement with the H. W. Dietert Company, of Detroit.

Bond Strength

The speaker then dealt with the trend of design for machines for testing bond, green, and dry strength of sands and oil sands. He described Dietert's universal sand strength machine, shown in Fig. 2, and explained that this machine was a simple and durably constructed piece of equipment of considerable accuracy. Depending upon dead weight rather than hydraulic pressure, it was almost impossible for the calibration of it to become disturbed.

The pendulum weight swung in a set of self-aligning ball bearings which were mounted on a steel shaft. Various testing heads could easily be slipped into place on the pusher arm to make different bond tests, such as compression, shear, and tensile. The hand wheel was turned to move the pusher arm up and thus cause the sand specimen to raise the weight. The stronger the sand the higher it would raise the weight. A magnetic rider on the scale showed the maximum height the weight was raised before the specimen collapsed, and the strength of the sand was read direct from the scale.

Attachments were available for determining high dry strength, and also deformation and resilience. Moulding sand, like other materials, might possess a satisfactory strength, but the strength was considerably limited due to a property which may be termed "deformation." For example, when a material was brittle, then its load-carrying power was very limited. Moulding sand might become "short" or brittle, though the strength was satisfactory. A factor termed sand resilience took into consideration both the strength and the deformation, and this added much to the green sand strength test.

Clay Determination

The speaker then described the rapid sand washer illustrated in Fig. 3. This was another Dietert design machine, and, like the others previously mentioned, had withstood the test of several years in foundry practice.

This sand washer consisted of an aluminium frame, an electric motor, a wash bottle, a syphon tube and a sand glass to time the operation. This unit furnished a most practical means of scrubbing the clay from the sand grains in accordance with the A.F.A. "fineness" test. It approximated to elutriation tests for clay substance in a fraction of the time. The wash bottle was made up of a clamping ring, a glass cylinder, and a brass cup in which the sand grains remained after completion of the syphoning operation.

The sand grains were dried in this cup, thus eliminating transferring procedure and filtering it. In carrying out the fineness test and clay bond percentage, a 50 gramme sample of the dried sand was placed in the sand washer, to which was then added 500 ml. of a very weak solution of sodium hydroxide. The motor stirrer was then run for 5 minutes, water added to fill the receptacle up to the line on the side and the sand grains were allowed to settle for 10 minutes. The supernatent liquid in which the clay was still in suspension was then syphoned off down to a certain level. Then two successive additions of distilled water were made and syphoning was repeated. After this, one filled with water again and syphoned after 5 minutes, repeating these operations until the water was clear after being allowed to stand five minutes. The base was then removed, allowed to settle for five minutes, then as much water as possible poured off carefully, after which the base of the wash bottle containing the wet sand grains was placed in an oven and dried. When dry, the percentage of clay was arrived at by a simple calculation. The sand grains were then transferred to a mechanical sieving machine and separated on a series of standard sieves after running the machine for 15 minutes.

FIG. 2.—SAND STRENGTH MACHINE.

Fig. 4 illustrates the "Inclyno" patent mechanical sieve vibrator, which was described by the speaker as a convenient machine for this purpose. He pointed out that the sieves did not rotate, but a rotating motion was imparted to the material on the sieves. The patentees also claimed two other features, viz., speed of vibration and a rotary rocking movement. These essentials ensured there was sufficient extraction.

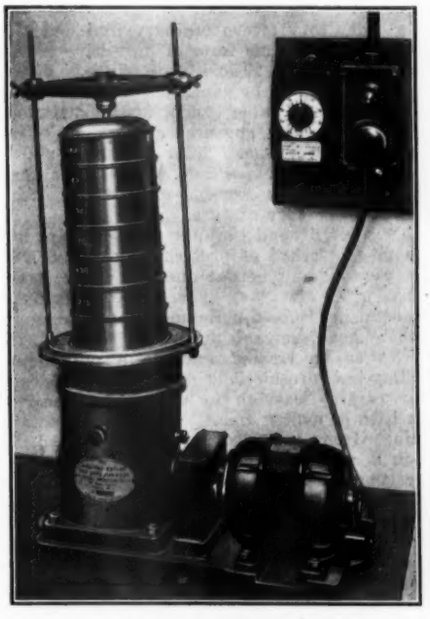


FIG. 4.—MECHANICAL SIEVE VIBRATOR.

Protection of Iron and Steel from Corrosion

The annual loss of iron and steel from rust or corrosion is enormous but incalculable. Corrosion is also responsible for what has come to be known as "corrosion fatigue." It is a definitely established fact that corrosion has the effect of seriously reducing the fatigue resistance (or endurance limit) of steel and thus leads to its ultimate cracking and fracture. The physical effects of corrosion upon structural steelwork and their influence in the design and maintenance of certain types of machinery and plant are, therefore, problems of vital interest to the constructional engineer and to the maintenance chief. For each the question is: "How can corrosion be avoided?"

What is Corrosion?

The corrosion of ordinary iron and steel is due to the combined influence of moisture, oxygen, carbon dioxide, and electrolytic action, the process being accelerated by acidic substances in the atmosphere. The rate of corrosion of an iron or steel surface depends upon the conditions to which it is subjected, and may vary widely. On certain metals a protective film or deposit is formed naturally, or it can be produced by artificial means. On zinc, for instance, under ordinary atmospheric conditions a film is formed which adheres firmly to the metal and protects it from further attack. High-chromium iron and steel—that is, the stainless-steel group—on exposure to the air also provide their own protective film or coat; but, of course, these alloys are more expensive and, therefore, limited in use. Ordinary iron and steel, on the contrary, are incapable of producing a protective coat of this kind. Mild steel in contact with the atmosphere becomes oxidised and forms rust. This layer of oxide or other corrosive products is of a porous character and retains moisture which readily takes up oxygen and acids from the atmosphere, thus still further accelerating corrosion.

Protective Coatings

In order to preserve ordinary iron and steel from corrosion, some form of protective coating must be adopted. The life of paint is limited because, owing to the expansion and contraction of the coating under temperature variations, cracks make their appearance, with the result that corrosive agencies gain entrance, and it is no uncommon experience to find that these coatings frequently drop off, carrying with them a substantial layer of rust.

It has been found that the most effective and economical method of protecting iron and steel from corrosive influences due to weather is by a coating of zinc, *i.e.*, galvanising. The term "galvanising" is usually understood to apply to the "hot" galvanising process, in which the articles to be treated undergo a preliminary pickling in hydrochloric acid to remove scale, and after careful washing in water are immersed in a bath of molten zinc. This process is totally distinct from the electro-galvanic method, in which a coating of zinc is obtained by electro-deposition. The coating in the latter case is comparatively thin, and is generally employed for the protection of smaller articles, and it is especially suitable for bolts, nuts, screws, etc., where zinc would be likely to collect in the threads if galvanised by the "hot" process.

Hot galvanising is recommended wherever possible because this process gives an even, substantial and homogeneous coating, which completely prevents the access of air and moisture to the basis metal. This galvanised surface after a short exposure to the atmosphere becomes coated with an extremely dense and insoluble deposit of zinc oxide and basic carbonate which protects the underlying zinc from further atmospheric action. The weather-resisting property of the hot-galvanised coating constitutes one of its most important advantages.

Adherence

From the point of view of adherence, the protective coating obtained by the hot-galvanising process is greatly superior to paint and similar coatings for outside exposure. The zinc coating becomes definitely alloyed with the surface of the iron, and it is interesting to know that this coating is composite in character and really consists of several layers, merging one into the other so that there is no really sharp boundary between the iron surface underneath and the pure zinc above. The hot-galvanising process is, therefore, recognised as the most durable and weather-resisting method of protecting iron and steel from corrosion, as well as the most economical.

In addition to the more general uses of hot galvanising with which foundrymen are familiar, there are many others in which it has been found of practical application. One of the most interesting and instructive examples is its use for the pylons of the "Grid" electricity system. The steel members of these pylons were galvanised before being assembled, and examination of the steelwork after some eight years' exposure to the weather shows no sign of corrosion. The saving in maintenance costs on these pylons must be very considerable, especially when the inaccessibility of some parts of the steelwork is borne in mind. They provide the strongest evidence of the effectiveness of galvanising as a highly protective and enduring agent under the most arduous conditions, and indicate the direction in which a further extension of the uses of the hot-galvanising process could be advantageously adopted.

Catalogue Received

Grinding Machines. A new catalogue, recently produced by F. E. Rowlands & Company, Limited, of Climax Works, Reddish, Stockport, is of particular interest to our readers. It opens with an illustrated description of a high-speed double-ended floor grinder, which incorporates a three-speed drive to take care of the wear of the wheels with the object of maintaining reasonably constant peripheral speeds. There are four sizes available, ranging from 14 to 30 in. These machines run at speeds ranging from 1,150 to 3,275 r.p.m. Slow-running machines utilising ordinary and not Bakelite-bonded wheels are covered by a second design available in three sizes. After a few pages of matter relating to tool grinders, a description is given of a high-speed double-ended face grinding machine, also available in three sizes. Disc grinding machines of the double-ended variety are largely used in connection with the machining of castings. All the machines, by the way, are of the type which houses the motor centrally at floor level between the two wheels, the whole being totally enclosed and so making a really neat job. Dust extraction and guarding have been intelligently tackled. The next section to interest foundrymen deals with a heavy-duty grinder for grinding work which is too heavy to handle. This is built in two sizes for using 16 and 20 in. wheels. Finally, amongst the special grinders is a face tool grinder for heavy roll-turning tools.

Steel Plant Investigations in Greece

The development of a steel industry in Greece continues to be studied. The consumption of iron and steel of the country is estimated at over 120,000 tons per annum, but the difficulty of building an independent iron and steel industry lies in the absence of suitable coal supplies, although experts estimate that production can be undertaken with the aid of electricity generated from the power of the rivers in Northern Greece. Investigations by experts into the various possibilities offering are being continued.

Pig-Iron and Steel Production

The British Iron and Steel Federation point out that there were 133 furnaces in blast at the end of December compared with 135 furnaces at the end of November, two furnaces having ceased operations during the month. The production of 783,800 tons of pig-iron in December included 171,500 tons of hematite, 433,200 tons of basic, 148,500 tons of foundry and 12,700 tons of forge pig-iron. The production of steel ingots and castings was 1,103,800 tons.

The appended table shows the average monthly production of pig-iron and steel ingots and castings in 1929, 1936 and 1937 and the production in each month since November, 1936.

	Pig-iron.	Steel ingots and castings.
	Tons.	Tons.
1929—Monthly average ..	632,400	803,000
1936 " "	643,500	982,100
1937 " "	708,000	1,080,300
1936—November ..	643,100	1,001,300
December ..	671,400	1,019,200
1937—January ..	650,700	998,900
February ..	603,700	995,900
March	680,300	1,109,500
April	680,700	1,080,400
May	696,300	1,047,300
June	699,300	1,106,400
July	729,300	1,059,200
August	714,000	987,700
September ..	726,600	1,163,000
October	769,600	1,133,600
November ..	762,300	1,178,300
December ..	783,800	1,103,800

Commenting on the figures, the Federation state that with the December outputs available, the picture for 1937 is complete. The tentative estimate of 12,900,000 tons for steel ingots and castings has been exceeded by 64,000 tons, thanks to the effective daily rate of output having been generally maintained in December at the record levels reached in November. It is calculated that over the whole industry, on the steel-melting side, an average of two working days were missed as a result of the Christmas holiday. While in a number of plants, continued pressure of work permitted a holiday stoppage on Christmas Day only, at other works, such was the urgency of repair work which had previously been deferred in the interest of accelerating production, that two to three days, and in some cases a whole week, were devoted to maintenance. In Scotland, stoppages in connection with the holidays began only at the turn of the year, and this will affect January output.

At the record output of 12,964,000 tons for last year, Great Britain has surpassed the 1929 peak by 34 per cent., whereas steel production last year in France, Belgium, Luxemburg, and the United States fell short of the record level reached in each of those countries in 1929. Germany's output (including the Saar) rose by less than 10 per cent. of 1929.

Pig-iron output in December, at 783,800 tons, compared with 769,600 tons in October, 1937, the previous highest in recent years. It is necessary to go back to 1918 to find a comparable rate of output. Consequent upon lower hot-metal requirements in steel melting-shops that were closed down for holidays and repairs, the daily rate of blast furnace output was reduced slightly in December. This was also due in part to one furnace being withdrawn in the second week, and another on Boxing Day. The total output of pig-iron in 1937 was 8,496,600 tons compared with 7,721,400 tons in 1936.

THERE IS A MARKED SHORTAGE of steel scrap in South Africa, and scrap consumers propose to form a pool to control scrap prices and to organise the central purchase of scrap.

Runners and Risers for Non-Ferrous Castings*

By F. DUNLEAVY

This problem is so interwoven with the question of casting and pouring temperatures that it becomes a very real problem to say definitely that any one particular method is the proper way to run a casting. Therefore, the author takes it for granted that everybody is working on the same lines, namely, filling the moulds with molten metal rapidly but quietly and so that the alloy will begin to solidify almost as

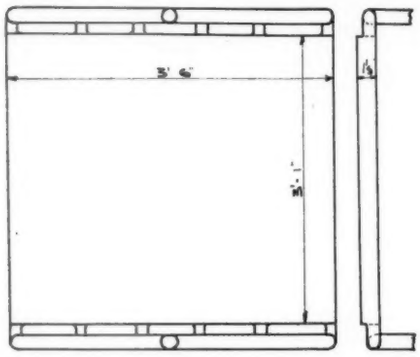


FIG. 1.—METHOD OF RUNNING ALUMINIUM PLATE CASTING.

quickly as the mould is filled. It must be understood initially that the author does not claim that the types of runners and risers shown are the only way of producing the castings to which he refers, but they do represent what, in his opinion, has proved to be the best way of running and feeding those particular types of jobs.

The object of the runner is simply to fill the mould with molten metal, but also the resultant

FIG. 2.—GROUP OF PHOSPHOR BRONZE CASTINGS. SPUR GEAR CASTING WEIGHS 19 LBS.; WORM GEAR CASTING, 7 LBS.; LARGE BUSH, 12½ LBS.; SMALL BUSH, 6 LBS.; RUNNER, 15 LBS.

casting must be free from all defects such as scabs, blowholes, airlocks, etc.; that is another and quite a different question, so the design of the runner and riser becomes a major problem. The function of the riser is to feed the unequal sections or those parts of the casting which, in the opinion of the foundryman, would otherwise be faulty due to those parts of the casting solidifying some time after the bulk of the job. The riser must contain liquid metal after the casting has solidified, and, in the case of non-ferrous alloys, after the casting has passed from the pasty to the solid state.

On certain occasions risers are used on flat jobs of large area to relieve the strain on the top part, but these are not feeders. Another instance of a riser that was not a feeder is illustrated by Fig. 1, which represents an aluminium plate 3 ft. 6 in. by 3 ft. by 1½ in. approx. This was cast from two ladles, one at each of the longer sides, and the inrunner extended almost the whole length of the job. The first plate was a waster, as round the centre of it two or three large airlocks had occurred. The job was re-made and the whole of the bottom face was chilled as was the first one, but the difference between the first mould and the second was that the latter had two risers in the centre, approximately 2½ in. diameter each. This and the following castings were sound, and obviously the metal had entered the mould quicker than the air could be driven out; this was one of those problems that the moulder is always encountering. In spite of these instances the riser or feeder is to feed the heavier section of castings of irregular section.

Phosphor Bronze Castings

Fig. 2 shows a group of phosphor bronze castings poured in a rather unorthodox manner. This is not exactly a new idea, but is one that is being tried out nowadays rather extensively. The object in following this method is an attempt to reduce the quantity of metal required to run these castings to a minimum and at the same time to have sufficient metal to feed them and ensure that the castings are sound and free from defects. By this method, since less metal is used, there is a saving in melting costs, and in the same manner the fettling costs are cut to a minimum.

An ironfounder looking at this illustration would suspect that the castings are wasters, because the well at the joint of the mould could not be kept full of molten metal, and thereby the resultant casting would be dirty, but in phosphor bronze alloys this is not the case. What is happening in this case is that all the scum and impurities that are some times seen on a rich phosphor-bronze mixture are kept floating on the top of the runner box or head, and the metal strains through the perforated core into the feeder. Now the metal obviously fills the moulds very slowly and is solidifying very rapidly, and when the mould is completely filled the four castings have almost solidified, with a mass of hot fluid metal with which to feed them.

All foundrymen will appreciate the fact that the ordinary riser or feeder loses a serious amount of heat by contact with the atmosphere and the sand. This is not difficult to understand when it is realised that in the average riser the metal has flowed through the mould and again comes into contact with the atmosphere. In this particular instance the hottest metal is found just in the position where it is required, and that is at the joint of the runner and casting. One proof of this statement is shown at the top of the feeder and the junction of the small diameter downrunner by its pronounced sink. Fig. 3 shows the castings after the top face had been machined and the block cut into halves by the milling machine. It will be noticed that the castings are quite sound. The process used makes the method of casting this type of job a very profitable one from every point of view. This group of castings, by the way, was cast at 1,110 deg. C. If the four castings were run in the ordinary manner a 2½-in. downrunner would probably be used and large ingates would also be incorporated.

The ingates for the bushes would be cut below the flange or a drawn flace could be expected underneath the runner and at the joint of the flange and casting. Another point to be noted is that very close control of the pouring temperature would have to be kept, because if cast at too iow a temperature the block casting would be drawn at the runner and airlocks could be expected on the top face, and if cast too hot a very spongy patch can be expected on the top of the casting and directly over the inrunners.

The author suggests that the average moulder, on receiving these four patterns in the foundry,

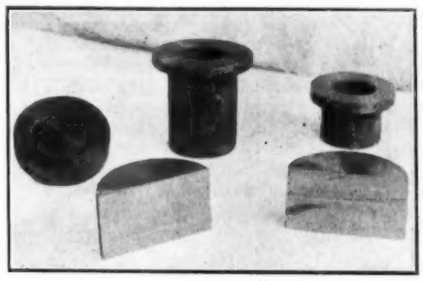


FIG. 3.—CASTINGS SHOWN IN FIG. 2, SOME AFTER BEING SECTIONED.

would run the two bushes and small gear together and the block would be run separately. This speaks much for the method shown.

Fig. 4 shows a group of small half-bearings weighing about 80 lbs. each, which are being cast successfully without risers. It has been proved that to place a riser on the small bearings is a mistake, always providing, of course, that the casting is of a fairly uniform section. Even the most enlightened of non-ferrous foundrymen, on looking at this photograph, will recall some of the pitfalls with this particular type of casting.

In many such instances of this character the riser will pull the casting instead of the casting pulling the riser, with the result that at the junction of the flange and body a large crack appears and the casting is raised. The reason for this crack is probably due to the flange

FIG. 4.—GROUP OF LARGE HALF-BEARING CASTINGS.

not being wide enough to allow a riser of sufficient volume of molten metal.

After the first two were cast, two more were cast with the riser protruding over the body of the bearing and with fairly good results, but after checking up the difference in the fettling cost and also listening to the complaint from the machine shops in regard to the unsightly appearances of these castings, the job was re-examined from a proper angle. They are now cast in green sand at a slightly higher casting temperature, and run in at both sides to eliminate all risks of scabbing from that source; a whistler off each flange allows the air in the mould to escape more freely and rapidly, and the resultant castings are very successful.

* Paper read before the East Midlands Branch of the Institute of British Foundrymen, Mr. W. T. Evans presiding.

Manganese Bronze or High-Tensile Brass

This is another alloy that demands special treatment when cutting runners and risers. Its habit of drawing in the most unlikely places is due to the lack of appreciation of its peculiarities. It is one of those alloys that seems occasionally to defy all the natural laws of foundry practice until the cause is found. Then the remedy is automatic. A shrinkage or draw at the joint of inlet and casting is a common form of defect to be seen in manganese-bronze castings, particularly if the casting has a rather deep joint. Very often, running in on the top part instead of the bottom will eliminate this defect. Wet sand or a too liberal use of the swab will also cause bad patches in this area. Casting at too high a temperature will cause these defects as will a wrongly designed inlet.

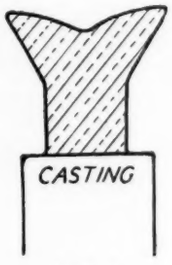


FIG. 5.

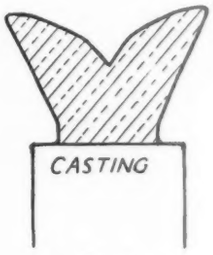


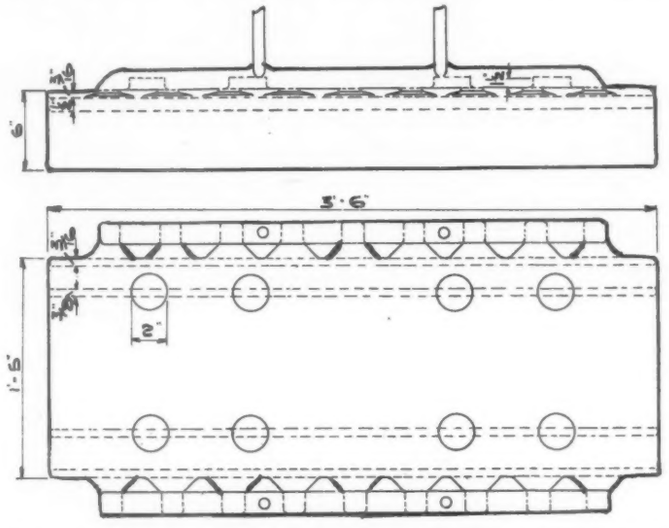
FIG. 6.

FIG. 5 SHOWS THE NORMAL TYPE OF RISER FOR PHOSPHOR BRONZE CASTINGS, AND FIG. 6 THE USUAL TYPE FOR MANGANESE BRONZE.

The least disturbance during the casting process causes this alloy to froth. The froth solidifies and the casting or castings are scrapped. This dross will not always rise to the top of the casting for if, during its flow through the mould, it comes into contact with the cores or any other obstruction it has a bad habit of clinging to these, and after machining the dross appears to go all through the casting. This trouble is due to wrongly designed runners. On no account must a down runner be placed directly over an inlet.

This alloy must be run quietly and evenly; hence the special design for ingates. Chills and risers are essential for all uneven sections. Figs. 5 and 6 show the difference between a riser for the average phosphor bronze and gunmetal and one for manganese bronze. The type of riser used in connection with phosphor bronze or gunmetal is useless for casting this alloy. All risers for manganese bronze must be cut so that the neck of the risers is as short as possible or a badly drawn place can be expected.

Fig. 7 shows a rather difficult job to cast in any alloy and very much so in manganese bronze. The job was ordered for two off. The casting was 42 in. long, 17 in. wide and 6 in. deep, with two ribs running the whole length of the job. These were $\frac{3}{8}$ in. wide and $\frac{1}{2}$ in. deep. The eight bosses on the top and outside of the casting were 2 in. dia. and $\frac{1}{2}$ in. deep. The rest of the casting was $\frac{5}{16}$ in. thick, so one will appreciate somewhat the difficulties when a sound casting free from all defects was demanded. It will be noticed that the flow of the metal is choked in two places: first in the runner box and secondly at the joint of the down runner and inlets.



FIGS. 7 (TOP) AND 8 (BOTTOM).—METHOD OF RUNNING A "DIFFICULT" CASTING.

In Fig. 8 the design of the inlets, which are very shallow directly under the scum runner and wider and thicker nearer the casting, is for the sole purpose of achieving a regular and even flow throughout. One point that cannot be omitted at this stage is that the two ribs and the eight bosses must be almost wholly chilled when the core is being rammed up, otherwise hollow places will appear on the top of the casting and directly over these ribs, and in the case of the bosses, particularly if they be heavy, drawn places may be encountered in spite of the riser.

The runner boxes and scum runners must be so arranged that they are kept full of molten metal. This is essential; otherwise the casting will be faulty, due to the dross flowing into the mould and becoming trapped into the casting. A row of whistlers is arranged in the centre of the top part and all along the length of the mould, to ensure that the air in the mould is given ample opportunity to escape during the casting process. If the venting is omitted, bad patches can be expected on the casting, probably due to the trapped air being unable to get away as quickly as the molten metal enters the mould, and, to all intents and purposes, it is a misrun casting.

The ribs also tend to obstruct the flow of the metal and stiffen it off somewhat, but that is a question of casting temperature.

Fig. 9 shows the method of casting a separate test-bar in manganese bronze. Here again, as was the case with the casting, the metal is choked first in the head and secondly at the inlet. One or two bars were cast without this scum runner, and one is shown in the photograph. The method did not meet with a great amount of success, because the metal has a tendency to flow rapidly to the opposite side of the mould, and on washing back causes a great amount of scum to form; this scum could be trapped in the bottom portion, which is cut away for the test piece, and if this did happen the bar is almost

FIG. 9.—SUGGESTED METHOD OF CASTING A MANGANESE BRONZE TEST-BAR.

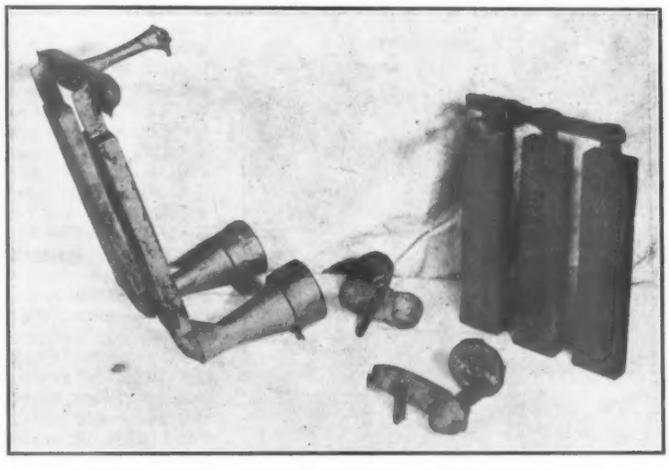


FIG. 10.—RUNNING METHODS FOR PLATE CASTINGS.

certain to be rejected. The pattern for the test bar and the block are shown at the sides.

What is perhaps one of the most important points about test bars made in this alloy is this pressure head. If an attempt were made to cast these bars in the same manner as would be the case with a gunmetal or phosphor bronze, the author has no hesitation in saying that there is trouble ahead, particularly when the foundryman hears the tensile and elongation results.

Fig. 10 shows a group of ordinary flat plates 12 in. by 2½ in. by 1 in. At the first attempt the castings were run from one down runner. All

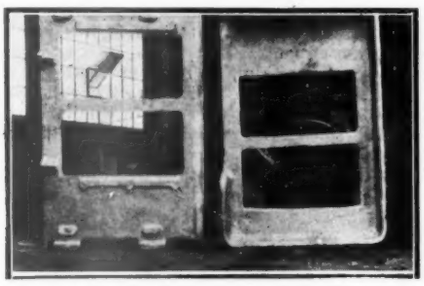


FIG. 11.—CASTING REQUIRING SPECIAL ATTENTION TO AVOID CRACKS.

three castings were faulty, and the reason was obvious. First the down runner was too small in diameter to run the castings, and at the same time choke the metal at the inlet. The alloy was entering the mould as fast as it was flowing through the down runner, and the scum runner was useless, with the result that the castings were scrapped. The top faces had also some very hollow patches. Therefore, instead of three patterns, two only were used with the same down runner, but with smaller inlets and a very much larger scum runner. These were quite sound, as were a batch of twenty-two which followed. They were all cast, including the first three, at 930 deg. C.

The run-offs at the opposite end to the gate were placed on for no other purpose than to observe the condition of the alloy as it came through the mould. A long stream of metal between crucible and mould must be avoided

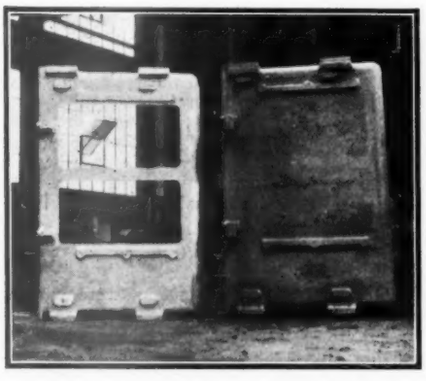


FIG. 12.—TRIAL CASTING SHOWING DEFECTS.

when pouring, or scummy metal will be formed, and the author would suggest that scummy metal has never yet made a sound casting. It is essential that the crucible be kept as low as possible over the runner box when casting. There must be no attempt whatever to force the metal through the mould; it must flow quietly and very smoothly. It must be understood that the author makes no claim that these are the only methods of making castings in this alloy, but that they are the methods which he employs in the production of sound manganese bronze castings.

Aluminium

Most of the older text-books, when referring to the running of aluminium castings, advise their running at the thinnest part; the utilisation of a riser at the heavier portions and to run them as low as possible in the mould. The idea is that the air is being driven out, but this is not always the case, and it has never shown itself as being satisfactory in the author's experience.

While there are no hard and fast rules available in placing gates for light alloy castings, it is a good maxim to use a number of wide and thin ingates in preference to one large one. The design of these ingates is very important, as lack of care may interfere with the contraction and crack the casting.

The advantage of these numerous ingates is that the casting temperature can be lowered considerably and solidification commences almost immediately, whereas, in many instances, castings run with one inlet would be faulty, due to metal being unable to flow throughout the mould and fill all the sharp corners. Again, if the temperature be raised to meet this trouble, gassed metal may be encountered.

Fig. 11 shows one of those jobs that defy all the ordinary methods of running aluminium castings owing to a crack appearing at the joint

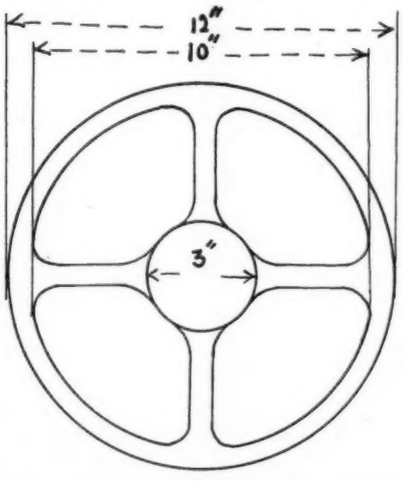


FIG. 13.—HAND-WHEEL CASTING WHICH REQUIRED SPECIAL TECHNIQUE WHEN CAST IN ALUMINIUM.

of the centre bar and outside strip. This crack was due to uneven solidification and the only way to run the casting successfully was by two wedge-shaped runners—one at each end of the casting and straight into the moulds. A suitable ascertained casting temperature is 710 deg. C.

In the first instance the metal was cast from two crucibles, one at either side of the mould, utilising numerous wide but shallow ingates. The casting temperature used was 740 deg. C. This trial casting is shown in Fig. 12, and was a waste "misrun." The metal, after covering the bottom of the mould and having reached the top of the core, was too dull to run. Another peculiar feature was a higher contraction with this higher temperature and method of moulding against the wedge runner. Fig. 13 shows an ordinary handwheel 12 in. dia. with the rims and arms of $\frac{3}{16}$ in. section. The centre boss is 3 in. dia. and 2 in. deep. This job can be successfully cast in phosphor bronze or gunmetal by running straight into the centre boss with a few whistlers on the outside rim, to allow the air in the mould to escape as freely as the metal enters the mould.

This practice of running is totally inadequate if an aluminium alloy be used. In this case it would be run by two inlets, one at each side of one of the arms, and a riser on the centre boss, and if the alloy be one with a high zinc content, a chill under the boss is essential. Neither of these methods would be satisfactory if the alloy to be used was a manganese bronze or high tensile brass. It would be essential to use a small down runner incorporating a large scum runner and four small inlets, first choking the alloy in the runner box, secondly at the inlets, and so ensuring that the metal flows through the mould. Any attempt to force it through otherwise would result in the production of wasters. A heavy chill is necessary, and a heavy feeder of the shape peculiar to these alloys is essential.

A Metal Band Grinding Machine

Some few weeks ago we acknowledged the receipt of a catalogue from Mr. F. H. Ockenfels, of Mill Street, Slough, dealing with, *inter alia*, the Frommia universal precision metal band grinding machine, Type 71, but we felt that our description required illustration to convey the exact nature of the machine. From the illustration we have procured, it will be seen that the machine arm can operate at any angle between the horizontal and the vertical, without resorting to the use of spanners. It is arranged to run at a maximum of six speeds, the belt being either 6 or 8 inches wide. The base of the machine serves both as a dust collector and for the purpose of housing a one h.p. motor. This is normally fitted with a three-speed V-belt driven pulley giving speeds ranging between 2,000 and 4,000 ft. per min. The dust-extracting

FROMMIA METAL BAND GRINDING MACHINE.

arrangement can alternatively be connected up to an existing plant. Arrangements for facilitating transport are also incorporated, and by releasing the lever shown at the back of the machine, a roller is lowered. The replacement of the lever fixes the machine firmly on its working place.

The grinding bands are either 52 inches or 64 inches long according to the type of machine. The choice of abrasive for use with the band is varied according to the nature of work to be done. Alternatively leather belts carrying paste suggest themselves for polishing purposes. The machine certainly has a number of features of real interest to the foundry industry.

Cast Iron in Marine Engineering

The tenth Thomas Lowe Gray Lecture to members of the Institution of Mechanical Engineers was delivered on January 7 by MAJOR P. L. JONES, M.C., B.Sc. His subject was "Recent Development in Ship Propulsion," and he made many statements of profound interest to foundrymen. The most important was in his conclusions, wherein he stated:—

"I would like to compare the marine oil engine of, say, five years ago with one which may be produced in the not far-distant future. In the earlier design, the bedplate, columns, entablature, pistons, etc., were invariably constructed of cast iron, the crankshaft, connecting rods, piston rods, etc., being, of course, of forged steel. The engine of a few years hence may be a complete inversion of this. Already in some designs the first four items mentioned are of steel. It is true that large crankshafts of cast iron have not yet been constructed, and this material may not at present be greeted with enthusiasm for the other working parts. There is, however, a definite move in the direction suggested, and with the very greatly improved grades of special cast irons now available, and the many excellent properties which they possess, particularly as regards resistance to fatigue stresses, the possibility of an engine of the type indicated is by no means ruled out; and the advantages of such a design, from the point of view of cheap and rapid production, will be obvious."

Developments in Welding

Major Jones' remarks on welding were also of distinct interest and well summarise the present position. He pointed out that the development of electric welding had had an enormous effect on ship construction during the last few years. As regards the hull, it was now quite common to weld bulkheads, oil fuel bunkers, engine casings, deck houses, deck plating, masts, pillars, shaft tunnels, etc. The result was a great reduction in weight of steel, and, in consequence, the power required to propel a ship of given dimensions had been appreciably decreased. In some ships the whole of the hull, including the shell plating, had been completely welded, and this resulted in a further reduction in resistance, owing to the absence of plate laps. It was not possible to assess the value of the latter feature, but anyone who had seen an all-welded hull being driven through the water would agree that it should be appreciable. There were now several all-welded ships in service, the largest of the kind so far built having a length of about 254 ft., but much larger vessels of this type were under construction.

As regards machinery, welding had made little progress in reciprocating steam-engine practice. Bedplates, columns, etc., of welded construction had been adopted in some cases, but due to the comparatively small size of modern steam engines and the complicated shapes of some of the parts, the savings in weight and cost achieved were not sufficiently attractive, and later designs had largely reverted to the normal cast-iron construction. In geared turbines, welded steel gearcases had been used, but in general cast iron was still adopted throughout. Here again, although in some cases expensive patternmaking was avoided, the saving in weight and cost was not impressive, and an important disadvantage was the possibility of increased noise. In one ship of which the author had knowledge, the noise from a welded steel gearcase cover was so great that an especially powerful telegraph bell had to be fitted in the engine room, as the engineers could not hear a normal bell unless standing close to it. Welding was very extensively used for general purposes in the engine room and stokehold. Condenser shells, main and auxiliary engine seats, shaft bearing seats, tanks, etc., were now invariably of welded construction, as well as many of the larger "special duty" valves.

Welding has had an enormous effect on oil engine design. For example, in the earlier engines the bedplate, columns, cylinder entablature, etc., were always constructed of cast iron, and this is also true of several engines being built to-day. In some of the modern designs, however, and notably in the opposed-piston engine, all the parts just mentioned are constructed of welded steel plates. Welding enables the designer to put the material exactly where it is wanted without regard to foundry requirements, and the result is an important reduction in weight and space. In the opposed-piston engine, for example, the reduction in weight of the present-day designs, as compared with those of eight or nine years ago, ranges from 22 per cent. for small engines of about 2,000 b.h.p., up to 32 per cent. for those of about 5,000 b.h.p. These reductions are entirely due to the adoption of welding, as for the purpose of comparison the same mean pressures and piston speeds have been adopted. Another important aspect from the point of view of the engine builder is the reduction in the cost of patternmaking, etc., which is of very considerable moment, especially as oil engine designs are continually being altered and improved.

Propeller "Singing"

Speaking of propeller singing, Major Jones observed that, during the last few years, this phenomenon had come very much to the fore. This usually took the form, he said, of a more or less continuous noise, sometimes of a very objectionable character, and was generally believed to be due to a form of blade vibration. It had only become of outstanding importance during the last three years at the most; and the reason for this was difficult to comprehend. During the last fifteen years he had been associated with the design and construction of well over 200 marine machinery installations and had attended the trials of most of them, and of many other ships also, but up to the middle of 1935 he had never encountered a singing propeller. Since that date, however, he had heard several. The design and manufacture of propellers were, of course, continually undergoing important changes, but it was safe to say that the modifications which had taken place within the last two or three years were comparatively small. Why then, he asked, should there be at the present time well over 100 known cases of the nuisance?

It was, of course, probable that some of these cases were not very serious, and would have passed unnoticed some years ago, when in any case the noises from other causes would tend to blanket propeller singing to some extent; nowadays, however, everybody looked out for the least suspicion of it. While many theories had been put forward, the difficulties in the way of satisfactory investigation of the problem were immense. Experimental work on scale models would, in the speaker's opinion, be of little value when applied to full-size propellers, and theories could only be satisfactorily tested in conjunction with actual ships. Anyone who had ever tried to run two trial trips on different days with the same ship and under even approximately similar conditions of wind, weather, etc., would appreciate the difficulty of carrying out systematic tests with the object of studying the effect of any one variable. Not only would the cost of such a proceeding be prohibitive, but the time spent before anything of value was obtained would be enormous. Moreover, deductions made in the case of, say, a single-screw ship of fairly bluff form would in all probability be of no value at all for application to ships of other types.

Some idea of the difficulty attendant on the investigation of this matter might be formed from the fact that in several twin-screw ships in

(Concluded on next column.)

Synthetic Moulding Sands

The following correspondence has risen from Mr. A. Tipper's Paper on "Naturally-bonded or Synthetic Moulding Sands?" which was printed in the JOURNAL for December 23 and 30, 1937.

From Mr. F. Hudson to the Author

May I be permitted to compliment you upon a very excellent and well thought-out Paper? There are two points, however, which are worth further consideration. The first is that, in your cost summary, you state that in this country the price of new moulding sand varies from 5s. to 10s. per ton delivered. These figures are not actually representative of ruling prices throughout the British Isles, as in many instances, for example, the cost of Scottish rotten rock sands is 17s. 6d. per ton delivered. Similarly, the price of silica sand varies from 4s. to 20s. per ton delivered.

I would suggest, also, that when any foundry turns over from naturally-bonded sand to a synthetic sand it might not always be an economic practice to commence production with a synthetic sand, made entirely from silica sand, bentonite and coal-dust. It is much more economical to bring about the change-over gradually, by stopping the addition of new sand and replacing this with silica sand in the form of old oil-sand, etc. In the course of a few months a synthetic sand will ultimately be in operation, which has been obtained at a very low cost indeed.

Author's Reply

Cost of New Sand.—My figures probably represent the bulk of English supplies, but are certainly not maximum figures, and I am glad this has been pointed out. Foundries possessing their own sand pits may, of course, obtain supplies at lower cost, but my figures are not intended to include such cases.

The second point referring to the advantages of making a gradual change of an existing naturally-bonded moulding sand to a synthetic sand certainly commends itself from the economic aspect and also because a gradual change is usually most desirable without upsetting conditions in the foundry more than necessary. I know that this procedure has been followed successfully in certain United Kingdom foundries. However, it may not be advisable in all cases, as, for example, where the existing moulding sand is low in permeability and strength due to unsatisfactory grading. Without a reasonably well-graded base sand, the synthetic bonded mixture may still suffer from the faults of the original natural bonded mixture, or require unduly high proportions of additions to maintain its condition. Obviously, this is where the experience of someone familiar with sand testing and control is really valuable.

(Concluded from previous column.)

which the propellers—as made—were, commercially speaking, identical, one propeller sings and the other does not. Cases had been known of a propeller singing badly while another propeller made to the same drawing and fitted to the same ship was quite silent. It would appear that singing was due to a combination of hull and propeller design, and was very much a "borderline" phenomenon; that is to say, quite a small difference might determine whether or not a propeller would be noisy. Singing had been experienced chiefly with propellers of the solid type, but some quite bad cases with built-up propellers were also known. Vessels driven by steam reciprocating engines, geared turbines, exhaust turbines, and oil engines had all alike suffered. As far as the speaker was aware, only one case of a cast-iron singing propeller was known, and for this reason it had been suggested that hysteresis of the blade material might have a considerable bearing on the problem.

Time and Motion Study in the Foundry*

By C. D. POLLARD

Seventeen years ago a prominent engineering periodical contained an article which commenced with the following passages:—"Machine moulding excepted, the methods employed in the foundry to-day are the same as they were a generation ago. It is perhaps the dirtiest and least pleasant of the engineering trades, and does not readily lend itself to academic treatment, hence it has but little interest for teachers of technical subjects.

"With a view to bringing the foundry into line with other branches of engineering, a most useful work is being done by the recently formed B.C.I.R. Association. There still remains, however, ample scope for propaganda in other directions, and in view of such facts the details of a foundry system which has proved in actual practice to be of inestimable value should be appreciated. The system to which we refer has been in successful operation for several years and is the result of a judicious combination of motion study, training, improved appliances, short hours of work and higher wages. Each of these constituents, extremely desirable in themselves, are for the purpose of efficiency, bound one with another. A good combination of these factors has been shown to effect an enormous increase of output with reduced hours, obviously to the advantage of employer and worker alike."

The scheme was then explained and a glossary given of the methods of its application.

That was in 1921, and the foundry to which reference was made has been, and is to-day, successfully carrying on under the same system. Such being the case, it should be of general interest to explore the possibilities of any benefit that can be derived from a more intimate knowledge of this time and motion study business.

It is not proposed to approach the subject purely as a costing system, but rather as it affects the production of castings and the foundry manager and his staff in their administrative duties.

The First Approach

As personal experience in foundry management prior to coming into contact with the system had been built up in foundries other than anything approaching mass-production shops, the author was perhaps somewhat sceptical as to its application in a foundry, but, realising that he could not remain sceptical and yet be successful in production, he strove to be neutral, whilst searching for any benefit that might be forthcoming.

After a short contact with the working of time and motion study methods, he came to the conclusion that it would assist the foundry executives in their administrative duties and in the control of their production costs, and to put into writing a summary of the conclusions from his analysis of the scheme, it is possible to say:—

Time and motion study leads to a centralised and permanently recorded knowledge, as a result of scientific investigation into the methods and requirements of production, and is a great aid towards standardisation whenever that is practicable.

It is known that variables in the foundry are a constant worry to the executive staff, and if by any method of control those variables can be reduced to a minimum, some benefit should be derived in the production of castings and in the ultimate cost of efforts. Foundrymen are always open to variables in scrap, fuel, sand, quality and temperature of molten metal, waste of materials, etc., all of which, by scientific control, can be brought within reasonable limits of consistency, but probably the most difficult of all variables is that which is introduced by the human element, and a few examples and illustrations are submitted as showing the possibility of reducing this factor to a minimum, by the application of scientific study and guidance of the operators' movements whilst they are in production.

Control of Variables

Lack of organisation is responsible for many variables, and employees cannot give 100 per cent. efficiency if the facilities offered them are haphazard. If skilled men are employed to do skilled work, they should have the opportunity of doing so all day. When unskilled employees are employed to do certain operations, they should be given the opportunity of doing those operations without hindrance.

The economical and methodical movements of materials to obviate the employees wasting energy by moving to and fro unnecessarily, and the establishment of the easiest and quickest method of doing any operations, are impossible when lack of organisation is permitted.

The introduction of so much machinery into the foundries has led to a vast amount of the work which was previously done by skilled men to be carried out by unskilled and semi-skilled labour; thus, whereas in the former case craftsmanship was the deciding factor in production, it is now a question of repeating some particular operation, or operations, as many times per hour as the layout of the foundry will permit. Therefore, success now depends to a far greater extent than hitherto on organisation and the methods adopted for the necessary control of costs.

Elimination of Guess-Work

There should be no question of asking an employee to do a certain amount of work in so much time, unless it has been established that what is asked is practicable and well within the capabilities of the individual doing the operation.

If the movements of operators are systematically studied whilst certain work is being carried out, and that study is spread over an extended period, it should be acceptable to all concerned that an average time for doing the job is worked out, and piecework prices fixed accordingly. Surely this is better than some individual thinking an operation should be done in such and such a time and fixing prices on that assumption?

There may be doubts as to which classes of foundry work time and motion study methods of control are applicable, and whilst repetition work lends itself to the system, the possibilities of such control extend into the realms of a far wider field.

There may be a feeling amongst some foundrymen that a foundry must be completely mechanised before any thought can be given to this system. Such is not the case; in fact, if such a system was introduced early enough, the cost of machinery installation would be kept within economical limits. The system proves that it is advisable to instal up-to-date equipment, but the figures also show the possibilities of production at low cost, without certain gadgets included in the category of mechanisation.

Scope of System

There must be moulding and coremaking machines, sand conditioning plants, conveyors, etc., but it is not essential to overload the foundry with mechanisation in order to introduce time and motion studies.

The first essential for the successful working of the system in any foundry is co-operation between the various sections of the organisation, and no mistake as to who is responsible for production. There must also be a feeling of confidence between the operators who are working under the scheme and the administrators of it. If suspicion be allowed to creep in on one hand or any attempt made to take advantage by forceful methods on the other, such a scheme could not possibly be a success. In fact a deadlock would be experienced.

It must be the duty of the time and motion study men to feed the foundry manager and his assistants with all the available information regarding the cheapest method of doing any job or operation, but at the commencement, *i.e.*, at the estimating stage, this factor must not be allowed to jeopardise the production of good castings.

It should be the foundry manager's duty and responsibility to his directors to make first-class castings at competitive prices, and from the point of view of quality of castings only those in authority over him who are acknowledged to have superior or equal knowledge in the science of production should dictate to him; but so far as prices and cheapest methods are concerned, the time and motion study men can be of invaluable assistance to him.

This is not because they are supposed to know as much about making castings as he does, but rather that they have in their files carefully compiled references to innumerable observations which have been recorded and tabulated, as a result of scientific study of the movements of foundry operators and materials during actual production.

The foundry manager who wishes to keep his job obviously does not ignore figures, yet it is known that managers in some cases have the experience of having figures presented to them which do not help to any great extent. In some cases the costing system precludes any opportunity for presentation of production figures to the foundry manager until an order is completed. When an order is completed is too late.

The manager should know how his figures compare with estimate whilst a job is in production, in fact he should know as far as possible what his costs are going to be to-morrow. In those foundries where a time and motion study system is worked, the foundry managers have the opportunity of checking production costs daily, or as often as is desired, on any operation. This obviates that bugbear of trying to find out why a loss was incurred on jobs which were completed a month or so previously, and leaving doubts as to which of the many variables has caused the loss. On the other hand, figures go from the works to the offices which do not convey all that they should represent to the accountant.

Usual Foundry Routine

Take, for instance, the variables which enter into estimating. The routine usually proceeds somewhat on the following lines:—On the receipt of an inquiry, and following a preliminary glance through it by the officials who distribute the morning mail, the inquiry is sent into the works after its travel through the necessary offices for entering details of receipt, estimation of weights, etc. The foreman patternmaker in all probability is the first to consider it. He estimates in time and money for making the pattern plant or tackle.

It is the usual practice for him to discuss methods of moulding, etc., with the foreman moulder, but unfortunately most foundrymen know that the love of interchange of views on this subject is not always a strong point in the daily routine of these two gentlemen. It may be the patternmaker who has the last word or it may be the moulder, and in consequence the quoted figures for later processes are influenced to a far greater extent than is realised by the accountant.

It is realised that the foundry manager does all this at some places, or at others he carefully

* Paper read before the Sheffield Branch of the Institute of British Foundrymen, Mr. J. B. Allan, M.A., presiding.

checks his assistants' figures, but the point to be stressed at this stage is that, in such routine, personal opinion governs the figures submitted by the works staff, involving variables all the time. Thus, whilst such estimating is carefully and skilfully carried out, much of it amounts to intelligent guess work. It is not the intention to convey that all the above is wrong, but rather to draw comparisons with what is to be submitted later. It is obvious that in jobbing foundries the estimating is a matter of experience and reference back to something like the job under consideration, but what of the medium and small castings?

Medium and Small Castings

Castings which are classed in these two categories are called for in reasonably large quantities, and the moulds are usually made on moulding machines. The variables on such production are a serious problem from the costs and manufacturing point of view, and some scheme of control of the operations, in order that correct allocations for costing purposes are possible, is of vital importance if the management is to know the profit or loss of any particular job.

The booking of time and materials in the patternshop may be a fairly straightforward job, and the resultant cost figures may be truly representative, but in the foundry and fettling shops it is probable that figures are not so near the truth. The management may get the correct records of the direct labour on individual jobs, but the variables in indirect labour and materials are often of a far more serious nature than occur in the direct labour.

What the costs departments ought to know is the total labour and material cost on each operation on every job, and it will be left to the reader to judge whether the time and motion study system would solve some of the problems of recording the actual cost of production.

Scheme Aids Progressing

The scheme is of assistance in progressing the work through the shops, as the information regarding tackle, methods of manufacture, etc., is available at a glance. The reference files give positive figures for production, per hour, of any operation; thus the question of meeting customers' requirements is simplified, if close co-operation between progress and time and motion study departments is maintained.

One of the difficulties of planning work to-day is caused by the necessity of varying the analyses of the metal. It is too much to expect that all the metal to be melted in one day will be of one analysis.

The delivery calls of the customers, coupled with the many types of castings on order, usually mean that metal of varied composition must be melted and poured from successive heats or charges, and in consequence the planning of work becomes a science as well as an art.

The planning department wants delivery regardless of inconvenience in the shops. The foundry manager wants all his moulds for what may be called No. 1 metal grouped together to avoid carrying molten metal in any one particular ladle all over the shops. He may be tempted to put certain pattern plant on certain machines to facilitate this grouping; the planning department may encourage him to do so, but from a cost point of view it would not be policy. It does not pay to rely on one's memory for such detail, as will prevent this robbing Peter to pay Paul, and some controlling influence should be brought to bear in these variables, otherwise the cost of production will fluctuate in no uncertain manner. So one could go on, but probably the better way would be to give a resumé of how the system is worked and illustrate other examples of the elimination of variables as it proceeds.

(To be continued.)

Use of the Microscope

At a meeting of the Midland Metallurgical Societies, held at Birmingham last month, MR. HAROLD WRIGHTON read a Paper on "The Expert Use of the Microscope." We append some extracts.

The technique of microscopy (said the speaker) may be divided broadly into two parts, first, the preparation of specimens, and second, the selection and adjustment of optical instruments. Methods of preparation of objects for the microscope vary so greatly that it is almost impossible to generalise, and no attempt is now being made to deal with this part of the technique, but it certainly should not be considered of minor importance.

The objective is the fundamental unit of the microscope, and it is desirable in the first place to have a clear idea of its main purpose, its properties and its limitation. Expert use of the microscope may be said to consist of the adjustment of conditions for each objective so that its images may suffer minimum impairment by aberrations, and of the control of illumination to secure maximum resolution together with a minimum loss of definition by glare.

A lens, not otherwise corrected, will show chromatic aberration, that is, the various coloured components of white light will be brought to focus at different distances from it. In the achromatic micro-objective, this trouble is corrected, broadly speaking, for the two colours, yellow and green, which are brightest visually, and such an objective, if used without a filter to remove blue light, may give blurred photographic images on account of the blue rays being actinically strong and of different focus. The great majority of metal specimens are, however, monochromatic in character and may be examined effectively under sharply filtered light of one colour or another. Spherical aberration, which should not be confused with curvature of field, is, on the other hand, of direct concern in precise microscopy of all kinds. When this remains uncorrected, no really sharp point image of a point of light in the object is attainable, and instead the optimum focus extends as a confusion disc of uniform diameter, forming a sort of cylinder along which the focus remains unchanged. By an inexperienced worker this may be misconstrued as evidence of "flatness of field." For each objective, there is a definite distance behind it at which the primary image must be formed in order to obtain sharpest definition. The "tube length" setting of an objective is made up of this primary image distance, plus the distance from this image plane to the eye lens of the ocular.

The higher the resolving power of an objective may be, as a result of wide angular aperture, and the more perfect its computation in respect of spherical aberration, the more sensitive it will be to any mis-setting of tube length. It follows, therefore, that a true comparison and selection of high-grade objectives is not possible unless one is able to determine the tube length adjustment with fair accuracy for each objective in turn.

Some of the modern "metallographs" carry an imposing array of fittings for illumination of various types, oblique, polarised, etc. It should be borne in mind, however, that "vertical" illumination is at present the standard method and the one most capable of revealing fine structural detail. In the choice of a "metallograph," provision for "critical" vertical illumination at all powers and for its proper adjustment should be carefully confirmed. The other methods of illumination are at present, and probably will remain, of secondary importance. The fundamental requirement for illumination is that from every point in the specimen which appears as light in the field of the microscope, a solid cone of light shall proceed sufficient to fill evenly the aperture of the objective, or that portion of it which may be in use, and that no other light shall be introduced. To be adequate for critical medium and high-power work, there should be provided:—(1) Means to utilise the full aperture of the objectives, and a sharp and clear control of the aperture when needed; (2) means to focus the illumination in accordance with any setting of tube length; (3) control of size of illuminated field, and (4) means to centre the illumination accurately, in the objective and also on the specimen, so as to make it truly axial.

Freedom from flicker and from displacement of the light centre during burning are combined with reliability and a very suitable symmetrically-shaped electrode in the Pointolite lamp. The intensity of the 100-c.p. d.c. model is sufficient for work at the highest powers under vertical illumination by the standard plain-glass slip reflector. The advent of dark ground illuminators and polarising equipment has led in recent years, however, to the re-adoption of the carbon-arc lamp in a number of metallographs. Whilst automatic control of arc lamps has been greatly improved, slight flicker and wandering of the arc on the crater still remain, to cause unsteadiness of illumination either over the field or at the objective aperture.

When microscope and illuminating train have been adjusted, the apparatus is in order for critical examination or for photomicrography. The aperture control is the one most subject to abuse. It should not be necessary to restrict aperture in order to secure reasonable flatness of field or to reduce glare, indeed, often with flat-backed low-power objectives, reduction of aperture will lower the true image brilliancy without materially reducing the back reflection, thereby making matters worse. The illuminated field, on the other hand, should always be restricted just to cover the area to be photographed; this invariably reduces glare and so gives greater contrast.

The technique so far described is applicable from the highest powers down to a magnification of about 50 diameters. At lower powers, however, short-focus micro-anastigmats are preferable to the ordinary micro-objectives. They have a sufficient resolving power and cover much larger fields, their images are projected direct to the camera screen and not through an ocular. As such large fields are covered, the composite bundle of rays forming the image spreads out widely, and may be cut off in part by a body tube which is not wide enough, or by a reflecting prism behind the objective not of ample size. The illumination is effected from a glass-plate reflector mounted between the objective front and the specimen. Very frequently the purpose of such low-power photographs is to portray surface irregularities such as inclusions or cracks, and a wide-angled incident beam is essential if these are to be faithfully imaged.

World Nickel Consumption

World consumption of nickel in all forms in the first ten months of 1937 attained the record total of approximately 201,000,000 lbs., an increase of about 24 per cent. over the corresponding figure for 1936, and comparing with 112,000,000 lbs. in the first ten months of 1929, states the annual review of the nickel industry by the chairman of the International Nickel Company of Canada.

Factors which contributed to this increase were the better pace of world business, the larger output of products containing nickel as an established component, the introduction of nickel into new products and the spread of nickel consumption to new industrial countries.

Although the final figures for 1937 will show minor variations the following percentages give a general picture of the relative importance of the various forms in which nickel enters world industry for consumption: Steels (constructional, stainless and other corrosion and heat-resisting steels, and steel castings), 55 per cent. Nickel cast-iron, 5 per cent.; nickel-iron alloys, 1 per cent.; nickel-copper alloys and nickel silvers, 10 per cent.; nickel brass, bronze and aluminium alloys castings, 2 per cent.; heat-resistant and electrical resistance alloys, 3 per cent. Monel, malleable, nickel, nickel-clad, Inconel, 12 per cent.; electrodeposition, 10 per cent.

West Yorkshire Foundrymen's Annual Dinner

The seventh annual dinner and dance of the West Riding of Yorkshire Branch of the Institute of British Foundrymen took place on January 8, at the Great Northern Victoria Hotel, Bradford, Mr. H. Forrest (Branch-President) presiding over a gathering of about 120 members and their guests. At the high table were the Lord Mayor and Lady Mayoress of Bradford (Alderman and Mrs. Henry Hudson); Mr. C. W. Bigg (President of the Institute); Mrs. H. Forrest; Mr. Joseph Hepworth, J.P., M.P. (President-elect of the Institute); Mr. Roy Stubbs (Past-President of the Institute) and Mrs. Stubbs; Alderman Cecil Barnett and Mrs. Barnett; Councillor and Mrs. H. J. White; Mr. H. Richardson (Principal of Bradford Technical College); Mr. L. J. Sargeant (general manager, Phœnix Works (Bradford) of the English Electric Company); Mr. E. Parkinson; Mr. R. D. Welford (Past Branch-President); Mr. S. Carter (Senior Vice-President of the Branch) and Mrs. Carter; and Mr. T. Makemson (general secretary of the Institute). Other Past-Presidents of the Branch present were Mr. A. S. Worcester, Mr. A. W. Walker, Mr. W. G. Thornton, Mr. F. K. Neath, and Mr. S. W. Wise (Hon. Branch-Secretary).

The Visitors

The CHAIRMAN (Mr. Forrest), proposing the toast of "The Visitors," said it was a privilege to welcome the Lord Mayor and Lady Mayoress of Bradford and Mr. Bigg, President of the Institute. The members of the Branch hoped to have these distinguished visitors with them again in June, when the Branch was to act as hosts at Bradford to the annual conference of the Institute for the first time. Mr. Bigg must have experienced a very heavy demand on his time and attention as President of the Institute, especially at this period, when the national organisation was undergoing certain changes in constitution. They welcomed amongst their visitors also Alderman and Mrs. Barnett and Councillor and Mrs. White as representing the civic authority of a great city in which the foundry industry played no small part. Mr. and Mrs. Stubbs they had had at the Branch dinner before, and the members were delighted to see them again. Principal Richardson, as head of the Bradford Technical College (proceeded Mr. Forrest) was one whom they welcomed with a feeling of deep gratitude for his great friendship and many kindnesses to the Branch and its work. Mr. Sargeant and Mr. Parkinson represented the industries with which foundrymen in West Yorkshire were closely associated, and Mr. Makemson, whom they had also had among them before, was welcome because they all knew and appreciated the valuable work he was doing for the Institute, and therefore on behalf of the foundry industry and all engaged in it. They were glad to offer hearty welcome to the ladies whom members of the Branch had brought as visitors.

The Branch officers appreciated very much the way the members had supported this year's function, particularly as the occasion might be regarded as a prelude to the big event in June, when the Branch hoped to be honoured by the company of a large and influential assembly of foundry industry leaders from all parts of the country and probably also some visitors from abroad. They hoped and expected to be signally honoured on that occasion by the election of their own Immediate Past-President, Mr. Joseph Hepworth, M.P., as President of the Institute—the first national President the Branch had provided. Mr. Forrest expressed a hope that the members would rally in great strength to help in making the first West Riding Convention a successful and memorable one in the annals of the Institute.

Civic Support for Convention

THE LORD MAYOR OF BRADFORD (Alderman Henry Hudson), responding on behalf of the visitors, complimented the Institute of British Foundrymen on its importance and its good work, and paid tribute to the evident enthusiasm and efficiency of the Branch. As a wool-textile man he confessed that, although he had little doubt that the work of the Institute must have had a very considerable effect on the efficiency or otherwise of work in his own industry, his personal knowledge of foundry subjects was abysmally small; so small, indeed, that during the dinner he had been entertained by the chairman to a most valuable and learned dissertation on aspects of the foundry industry, most of which might just as well have been spoken to him in Chinese! His Lordship said he could, however little he might know of the inner mysteries of the foundry, assure the gathering and the members of the Institute that he wished them every success, and in his capacity as Lord Mayor of Bradford he would do his utmost to make the visit of the Institute members in June an enjoyable one.

A GROUP PHOTOGRAPHED AT THE DINNER OF THE WEST RIDING OF YORKSHIRE BRANCH OF THE INSTITUTE OF BRITISH FOUNDRYMEN.

Left to Right: Mr. Joseph Hepworth, M.P.; Mr. H. Forrest; Mr. C. W. Bigg; and Mr. S. W. Wise.

Local Achievements

MR. C. W. BIGG (President of the Institute), proposing the toast of the "West Riding Branch," said he was delighted to have the opportunity again to attend the Branch's annual function. In regard to the Institute, it would be quite unnecessary for him to dwell at any length on that subject or about the coming Conference at a gathering of the West Yorkshire Branch. He questioned whether there was much about the Institute that they did not know, for the Branch was wonderfully active and had some very fine representatives on the General Council.

One of the most important phases of the Institute's work was on the educational side, and no Branch was more enthusiastic in supporting that work than was the West Riding. In reading the report of Mr. Forrest's Presidential Address Mr. Bigg noticed the claim that the West Riding Branch could show a better attendance record than any branch in the Institute. He had no information which would enable him to confirm that claim or otherwise, but if it were so the attendance record must certainly be a good one to give Mr. Forrest confidence to make that statement, knowing, as he did, that on the average the Branches did get very fine attendances at their meetings. Those attendances were particularly remarkable when it was realised that in many Branches—as was the case locally—members were scattered over a considerable area and therefore had to travel substantial distances to and from the meetings.

He congratulated the West Riding Branch on the economical efficiency with which its affairs were conducted. This, like many other phases of local work, reflected great credit on the officers and Council and particularly on the Honorary Secretary, Mr. Wise. The Institute was remarkably fortunate in its Branch secretaries and nowhere more so than in the West Riding Branch.

Branch Libraries

He congratulated the Branch on having a technical reference library. Only two Branches, he thought, did this, and to his mind it was an excellent idea which he commended to all Branches. The conduct and history of the West Riding Branch had been such as to make it most appropriate that it should entertain the Conference and provide the Institute with a President. It was, of course, no light task to stage the annual conference, but he was confident that this of 1938 at Bradford would be the best and most efficient ever held—except the one at Derby. (Laughter.)

MR. S. CARTER (Senior Vice-President of the Branch), responding on behalf of the members, said they would do all in their power to make an outstanding success of the first convention in this area, and Mr. Hepworth, the President-designate and one of their own most esteemed members, could rest assured he would have the utmost support and co-operation on the part of his own Branch in whatever he might be called upon to undertake during his year of office. So far as concerned plans and arrangements in the area for the conference, these were well in hand. As might be expected, Mr. Wise, their hon. secretary, had taken the bulk of the work on his own shoulders, with, of course, the help of his colleagues.

The speeches were concluded by 8.30 p.m. and were followed by dancing until midnight, to the music of George Mac and his Band. Messrs. A. W. Walker, P. H. Durrans and N. W. Riley acted as M.C.s.

Activated Carbon

We recently referred to activated carbon in a leading article, and as a result the following notes have been received from a reader. As a material for mixing with sand it might, we imagine, present interesting features. The article submitted reads:—

One of the vital products for the defence and general safety of Great Britain is activated carbon, which is used for gas masks. It will be remembered that charcoal (carbon), made by carbonising wood, adsorbs gases to some extent because of its cellular nature. Activated carbon is a very special form of carbon which possesses the power of adsorbing gases to an enormously greater degree than charcoal, and was first produced for this purpose in the World War. As a filling for gas masks its function, along with a suitable incorporated filter, is to remove all poisonous and dangerous gases from the air before breathing, thus ensuring complete safety. Some other uses also are for decolourising liquids and the recovery of solvents and vapours from the air or other gases.

Although activated carbon is manufactured in Great Britain it has been stated that a large amount of the material is being imported from foreign countries. The writer is informed, however, this is absolutely untrue, as the amount imported is extremely small and almost the total requirements are already being manufactured in Great Britain. Also, when the demand for civilian gas masks is satisfied, there will be an enormous potential output available for ordinary commercial purposes.

One well-known Lancashire firm, who are the pioneers in this field and the largest manufacturers in the world of activated carbon, are turning out a huge amount of high-grade material and have been engaged in its manufacture since 1914. Cocoanut shell charcoal usually constitutes the raw product for gas-mask carbon, but this firm has developed processes whereby all varieties are made from British coal, so that, in case of war, home supplies of raw material are available in unlimited amount. So far as the manufacture and use of activated carbon is concerned Britain also now leads the world.

Nitrided Sintered Iron

An interesting piece of work has been disclosed in the Dr.-Ing. Dissertation of GÜNTER HAENSEL (Technische Hochschule, Breslau, 1937) concerning hard metal cutting tools. The most successful materials of this class are either the cast Stellite or the fritted Widia types, the latter being made by a powder technique. The basic constituents of these materials, notably tungsten and cobalt, are expensive, and place such tools at a disadvantage. Particularly is this disadvantage felt in Germany, which must of necessity obtain these raw materials from foreign markets. It is not surprising, therefore, to find activities in Germany directed towards the development of cheaper materials of the cutting tool class.

The work referred to here concerns itself with the study of sintered and cast white irons in this connection, and in particular with respect to the possibilities of nitriding these materials. In an extensive investigation along these lines, sintered white iron did not prove satisfactory as a cutting material although high-carbon, high-manganese irons in the cast condition developed remarkable efficiencies. The figures quoted do not, of course, attain those obtainable with tools of the Widia class by a long way, but nevertheless bear very favourable comparison with the cutting efficiencies of carbon tool steels.

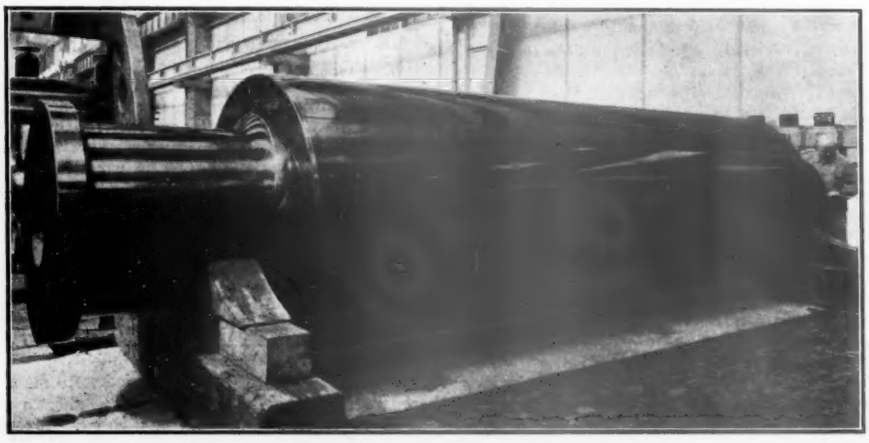
In attempting to increase the hardness of such sintered materials by nitriding at 500 deg. C. for 120 hrs., Dr. Haensel found a *decrease* in hardness of 120 Brinell, and was, in addition, unable to obtain material increases in hardness by this method in compacts prepared by sintering reduced iron powder or iron and chromium powder mixtures. On the whole, therefore, these experiments can only be described as unsuccessful, although it is difficult to believe that the results aimed at are in any way impossible. For one thing, Dr. Haensel has not paid sufficient attention to the use of alloy iron powders (which are very different from powder mixtures), to the use of binders (by analogy to the use of cobalt with tungsten carbide), and in particular to the incorporation of case-hardening or nitriding substances in with the powder prior to compression and sintering. Very satisfactory hardness figures have been obtained in this manner (British Patent Application No. 11933/37).

W. D. J.

World's Heaviest Cast-Steel Roll

We are indebted to Mr. John A. Smeeton, M.I.Mech.E., for the accompanying photograph of one of two cast-steel backing rolls for a Sack four-high reversing plate mill. The roll was cast by the Bochumer Verein für Gussstahlfabrikation A.-G., Bochum, Germany.

The roll has a barrel length of 16 ft. 8 in., and a machine finished diameter of 64 in. The overall length of the roll, which weighs 67 tons, is 23 ft. The rough cast weight was 84 tons 10 cwts., and it is interesting to note that, because of its great length, the roll was cast horizontally, using a steel which gave 44.5 tons per sq. in. tensile strength. The roll is hollow and carries a 35½-in. bore, whilst the necks have a 16-in. bore.



CAST-STEEL BACKING ROLL, 23 FT. LONG, MADE BY THE BOCHUMER VEREIN FÜR GUSSSTAHLFABRIKATION A.-G.

Welding Repairs

The heads of two hydraulic presses, which fractured recently, were successfully repaired by welding, resulting in a considerable saving of time and money. The presses belonged to the same firm; the heads weighed 15 tons, the dimensions being 6 ft. by 6 ft. by 3 ft. 6 in. The

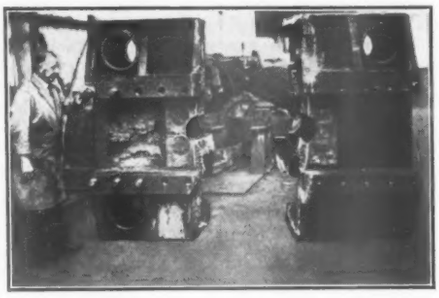


FIG. 1.—HEAD BEFORE WELDING.

thickness of the different sections varied between 3 in. and 5 in. Fig. 1 shows the fractured head as it was when taken from the press, and Fig. 2, the head after welding. More than a ton of welding material was used in the repair

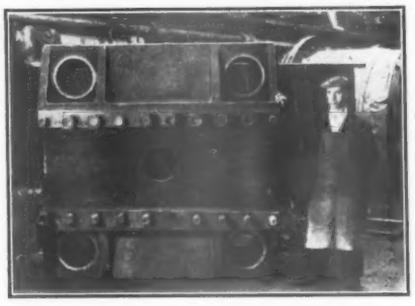


FIG. 2.—HEAD AFTER WELDING.

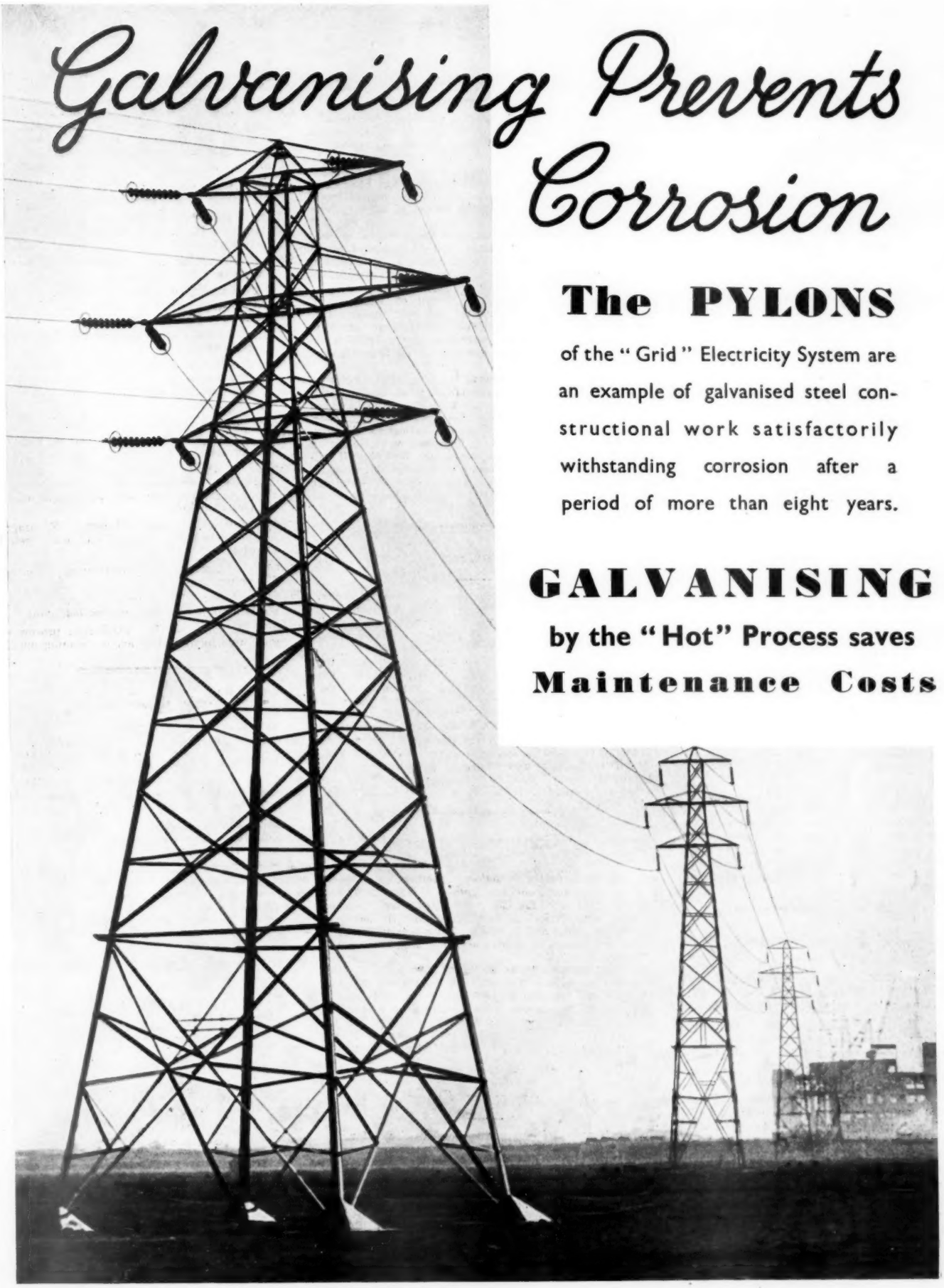
of both jobs. The work was carried on night and day by Barimar, Limited, of London, and the company concerned was soon enabled to put the press into production.

Catalogue Received

Aluminium Paint. A new booklet of particular interest to engineers, executives and works managers in every industry, as well as to architects and builders, has just been published by the Northern Aluminium Company, Limited, Bush House, London, W.C.2. It is, in effect, a survey of many of the present and potential uses of aluminium paint manufactured from paste. The general benefits of an aluminium paint are discussed and test results are quoted to indicate the reasons for the rapid replacement of aluminium powder as a metallic paint pigment by the new paste. The booklet is divided into about twelve main sections dealing with the use of aluminium paste paint for the protection of wood and metal, its value in painting storage tanks and pipes, for the preservation of steelwork, cement finishes, etc. Another section deals with aluminium ink made from paste. A useful concluding chapter contains a list of recommended media for use with the new paste. Practical guidance on the application of the product under the various categories is also given in easily read tabulated form.

THE ENGLISH ELECTRIC COMPANY, LIMITED, has received a contract from Bradford Corporation for 57 complete trolley-buses.

Galvanising Prevents Corrosion



The PYLONS

of the "Grid" Electricity System are an example of galvanised steel constructional work satisfactorily withstanding corrosion after a period of more than eight years.

GALVANISING

by the "Hot" Process saves

Maintenance Costs

The Week's News in Brief

Trade Talk

WORK has begun on the preparation of the site for a factory for the Saturn Oxygen Company at Pallion, Sunderland.

JOHN I. THORNYCROFT & COMPANY, LIMITED, have reopened their North Yard, Southampton, which has been closed for a number of years.

JAPAN IS AGAIN buying American pig-iron after being out of the market for many months, an order for 25,000 tons having been placed.

J. H. FENNER & COMPANY, LIMITED, power transmission engineers, Hull, state that the Bolton, Preston, and Liverpool area will in future be covered by their sales engineer, Mr. G. Toll, working from Manchester, where stocks are maintained.

THE IMPORT DUTIES ADVISORY COMMITTEE give notice that they have under consideration the question of exempting machinery belting and machinery parts made of leather from the scope of the duty of 30 per cent. *ad valorem* chargeable under Group XV of the Tariff.

THE PRIME MINISTER is to be principal guest and speaker at the banquet to be given by the Government at the Mansion House on February 21, to mark the opening of the British Industries Fair. The President of the Board of Trade (Mr. Oliver Stanley) will preside.

SKODA, the Czecho-Slovak metallurgical and engineering firm, has been awarded a contract by the Egyptian State Railways for the supply of four locomotives to a value of £13,532. The lowest British tender was £4,097 per locomotive, according to a report from Cairo.

THE FIRST "Manchester Association of Engineers' Lecture" is to be delivered by Sir William H. Bragg, O.M., K.B.E., D.Sc. (President of the Royal Society), on February 9, in the Great Hall of the College of Technology, Sackville Street, Manchester, at 7.30 p.m. His subject will be "Crystallography and the Engineer." The Lecture is intended to be given annually by a distinguished scientist.

THE KON. NED. HOOGOVENS EN STAALFABRIEKEN, Ijmuiden, which started making cast-iron pipes last year for sale in Holland only, is to erect a steelworks which may be completed by the end of this year. Only semis are to be manufactured, which will be delivered to re-rollers. Pig-iron output of the concern in 1937 was much above the figure for 1936, and a substantial tonnage was exported.

IN ADDITION TO the Dai Nippon Nickel Company, which started operation of its plant recently, four new nickel manufacturing enterprises are reported as planned in Japan by "Asia Press." While Japan consumes approximately 2,700 metric tons of nickel a year, she depends on importation for the whole annual requirement. The plant of the Nippon Nickel Company has a daily production capacity of one metric ton, although this is expected to be expanded in the future.

Book Review

Agenda Dunod, 1938—Métallurgie. By R. CAZAUD. Published by Dunod, 92, Rue Bonaparte, Paris, V. Price 25 fcs.

The 54th edition of this well-known handbook has been thoroughly revised and brought up to date. As examples of this, quite reliable compositions are given of nickel-chrome cast irons for various purposes, and excellent notes are included on the element beryllium. Practically all the commercial metals are covered in a very intelligent manner, whilst such subjects as calculation are dealt with by the inclusion of mensuration, many pages of tables and English measures. A rather striking omission for a handbook of this character is a table enabling one rapidly to change tons per sq. in. into kilograms per sq. millimetre. The book, which measures about 6 in. by 4 in., contains about 450 pages and is adequately illustrated. It has no counterpart in the English language.

V. C. F.

Personal

MR. WILLIAM BORLAND, who has retired after 40 years' service with Glenfield & Kennedy, Limited, Kilmarnock, has received a presentation from his colleagues in the patternmaking department.

MR. PETER F. BENNETT, chairman and managing director of Joseph Lucas, Limited, has been nominated by the Grand Council of the Federation of British Industries as President-elect of the Federation.

MR. ROBERT HUTTON, for many years foreman moulder with the Shotts Iron Company, Limited, has taken up a similar position with R. Y. Pickering & Company, Limited, Wishaw. He is succeeded by Mr. R. Beresford, assistant foreman.

MR. R. R. STOKES, chairman of Ransomes & Rapier, Limited, engineers, has been recommended by Ipswich Trades Union and Labour executive committee as Labour candidate in the Ipswich by-election caused by the elevation of Sir John Ganzoni to the peerage.

MR. FRANK S. RUSSELL, of General Refractories, Limited, is to have associated with him as joint managing director, Mr. R. A. Kirby, who has been in charge of the company's Scottish interests. Later, Mr. Kirby will be appointed managing director. This action is due to the increased work following upon the growth of the company. Mr. Russell will continue to act as chairman of General Refractories, Limited, as also of J. Grayson Lowood, Armitage Works Company, Limited, and other concerns in the group.

Obituary

MR. FRANCIS PEGLER, managing director of Peglers, Limited, brassfounders, of Doncaster, has died.

MR. WILLIAM EDWARD CHADWICK, late mill manager for Guest, Keen & Nettlefolds, Limited, East Moors Works, Cardiff, died last week.

MR. ESAU JAMESON SMITH, who for 30 years was chief engineer to the Darlington Forge, Limited, has died. He retired in 1924. Previously he was with Bolckow, Vaughan & Company, Limited, of Middlesbrough. He was 84 years of age.

MR. THOMAS CALLAN, of West End, Tweedmouth, who died on January 14 at the age of 85, was for many years in the employment of W. Elder & Sons, Limited, agricultural engineers and ironfounders, of Berwick-upon-Tweed. He began work as a moulder in a Berwick foundry at the age of 11.

Company Reports

International Combustion, Limited.—Net profit for the year ended September 30, £177,655; brought in, £24,733; reserved for income-tax and N.D.C., £20,000; final dividend of 12½ per cent. and a bonus of 10 per cent., making 30 per cent.; to reserve account, £50,000; carried forward, £17,878.

Westinghouse Brake & Signal Company, Limited.—Net profit for the year to September 30 last, £275,632; brought in, £60,060; to general reserve, £75,000; to pensions reserve, £10,000; written off book value of goodwill, £31,993; dividend for the year of 10 per cent. and a cash bonus of 7½ per cent.; carried forward, £70,569. Meeting, February 8.

Contracts Open

Beddington, January 22.—Iron castings, for the Beddington and Wallington Town Council. Mr. S. F. R. Carter, borough engineer, Town Hall, Wallington, Surrey.

Marple, January 26.—Spun cast-iron pipes, 4 in. and 6 in. dia., spigot and socket, all to the B.E.S.A. specification, Class B; standard special cast-iron castings of 4 in., 6 in. and 8 in. dia., to B.E.S.A. specification; steel or cast-iron water tank of 15,000 galls. capacity, for the Town Council. Mr. T. Cooper, water engineer, Council Offices, Marple, near Stockport.

Patent Specifications Accepted

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

475,256. SCHLOEMANN AKT.-GES. Rotating shears for cutting moving rolled metal.

475,345. BRASSERT & COMPANY, LIMITED, H. A., BRASSERT, H. A., and COLCLOUGH, T. P. Manufacture of iron.

475,359. DEUTZMANN, A. Cementation of steel and alloy steels.

475,382. KRUPP GRUSONWERK AKT.-GES., F. Roller bed having collecting pockets on either side thereof for material being rolled.

475,394. BUDERUS'SCHE EISENWERKE. Socket-pipe connections.

475,401. SOC. D'ELECTRO-CHIMIE, D'ELECTRO-METALLURGIE, ET DES ACIERIES ELECTRIQUES D'UGINE. Process and apparatus for ensuring regular casting of metals.

475,499. DEMAG AKT.-GES. Converters.

475,644. CHACE, T. B. Production of metal-clad iron or steel.

475,828. HERAEUS-VACUUMSCHMELZE AKT.-GES. Methods of increasing the resistance to heat of alloys containing iron and aluminium with or without chromium.

475,889. SUTTON, H., and LE BROCQ, L. F. Impregnation of metallic castings and other metallic objects.

475,895. ELECTRO METALLURGICAL COMPANY. Chromium steels.

475,896. ELECTRO METALLURGICAL COMPANY. Alloy steels used for welding and welded joints.

475,929. HINSLEY, J. F. Electrolytic process and apparatus for descaling and/or cleaning metals.

New Companies

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)

Gray & Company (Brassfounders), Limited, 18, Larbert Street, Glasgow, C.4.—Capital, £500. Director: W. P. Gray.

Charles Styles, Limited, 77, New Bond Street, Birmingham.—Capital, £4,000. Engineers and founders. Director: C. F. Styles.

Burdon Furnaces, Limited, 36, West Princes Street, Glasgow.—Capital, £5,000. Furnaces designers and builders. Directors: J. M'Quarrie and P. C. Walker.

Forthcoming Events

JANUARY 27.

Institution of Mechanical Engineers (North-Western Branch):—"Cast Materials for Crankshafts," Paper by W. West and J. G. Pearce, at Engineers' Club, Manchester, at 7.15 p.m.

Institute of British Foundrymen

JANUARY 24.

Falkirk Section:—"Surprise Item," at Temperance Café, Lint Riggs, Falkirk, at 7.15 p.m.

JANUARY 29.

Birmingham, Coventry and West Midlands Branch:—Annual dinner and dance, at Botanical Gardens, Edgbaston, Birmingham.

Newcastle-upon-Tyne Branch:—Joint meeting with Institute of Metals. "Randupson Process of Cement Moulding," Paper by F. W. Rowe, at Neville Hall, Westgate Road, Newcastle-upon-Tyne, at 6.15 p.m.

The Institute of Vitreous Enamellers

JANUARY 27.

Scottish Section:—"Moulding Sands and Facings," Paper by H. McNair, at Royal Technical College Society's Rooms, Glasgow, at 7.30 p.m.

TOR ROCK SAND
for the
FOUNDRY

Higher casting temperatures in iron foundries—particularly in those where special alloys are melted—have resulted in a demand for a moulding sand to withstand severe conditions and produce sound castings of good finish. Tor Rock Sand has proved to be specially suitable for these requirements. It is coarse in grain and highly permeable and being somewhat irregularly graded, tends to give a strong and compact mould surface.

Please write for full particulars and sample to the nearest sales office:

GENERAL REFRACTORIES LIMITED
GENEFAX HOUSE, SHEFFIELD.

Telephone: 31113 (6 lines).

Telegrams: "Genefax, Sheffield."

LONDON OFFICE: Russell House, Adelphi, W.C.2. Telephone: Temple Bar 3511. Telegrams: "Genefax, Rand-London." (Mr. A. C. Turner).

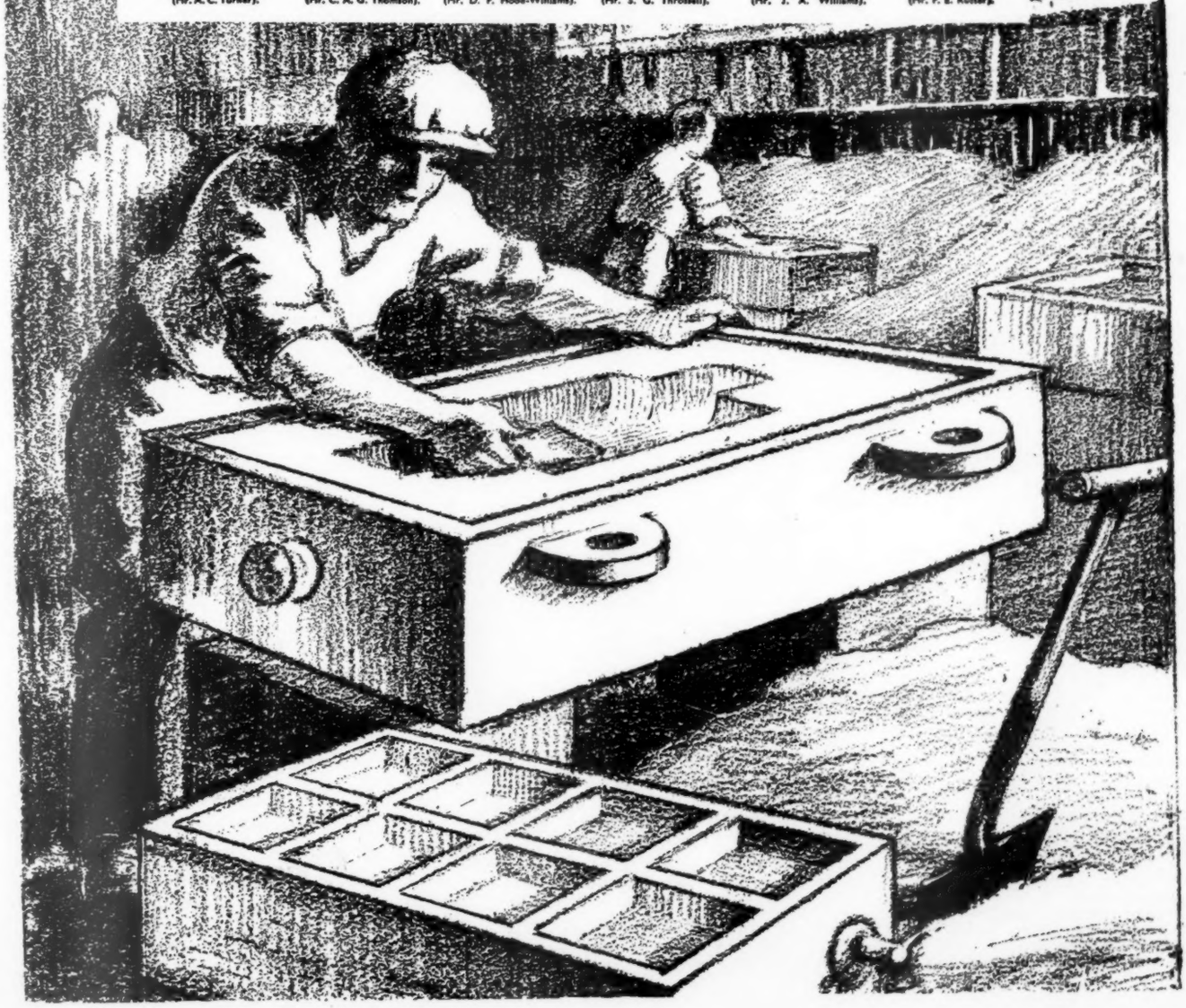
SCOTTISH OFFICE: 48, West Regent Street, Glasgow, C.2. Telephone: Douglas 6108 (3 lines). Telegrams: "Genefax, Glasgow." (Mr. C. A. G. Thomson).

SWANSEA OFFICE: Metropole Chambers, Wind Street. Telephone: 3680. Telegrams: "Genefax, Swansea." (Mr. D. F. Hood-Williams).

MANCHESTER OFFICE: 9, Albert Square. Telephone: Blackfriars 6130. Telegrams: "Genefax, Manchester." (Mr. S. G. Throssell).

MIDDLESBROUGH OFFICE: Halifax Bldgs, Exchange Place. Telephone: Middlesbrough 3313. Telegrams: "Genefax, Middlesbrough." (Mr. J. A. Williams).

CARDIFF OFFICE: 17, Windsor Place. Telephone: 5784. Telegrams: "Genefax, Cardiff." (Mr. F. E. Russar).



Raw Material Markets

Despite the fact that delivery arrears on contracts are still quite substantial, steel producers have taken further orders for delivery over the first half of the year. Thus, producing plants are assured of full-time operation until the end of June, even if demand does decline, as has been forecast in some quarters. Steel prices have been fixed up to the end of the year. The pig-iron supply position is now much easier.

Pig-Iron

MIDDLESBROUGH.—Although the position as regards deliveries of Cleveland foundry iron is more satisfactory than it was, consumers are still having to go elsewhere, generally to the Midlands, if they want to acquire supplies within a reasonable time. It would appear that if the situation is to become easier, it will only be as a result of a decrease in the demand, as there is little prospect of any material expansion of output owing to the heavy requirements of the steelmakers. For delivery in Middlesbrough and Falkirk, No. 3 Cleveland G.M.B. iron is quoted at 109s. per ton, with No. 1 foundry at 111s. 6d., and No. 4 foundry and No. 4 forge at 108s.

While new business over the first half of the year in East Coast hematite has been substantial, there is a good tonnage available for deliveries under previously-arranged contracts, and users are well served in this respect. Larger tonnages are also being despatched abroad. East Coast mixed numbers are quoted at 132s. 6d. on the North-East Coast, 138s. in Sheffield, and 143s. 6d. in the Midlands, less 5s. per ton rebate. No. 1 quality is 6d. extra, while export quotations are subject to negotiation.

LANCASHIRE.—With the exception of various sections of the textile-machinery industry, consumers in this area are well employed and deliveries of pig-iron are being made on a good scale. Machine-tool makers have well-filled order-books, both on home and export account, and prospects, on the whole, are satisfactory. For delivery to users in the Lancashire price zone, offers of Derbyshire and Staffordshire brands of No. 3 foundry iron are on the basis of 114s., with Northamptonshire at 112s. 6d., and Derbyshire forge iron at 111s. to 113s., according to the class of consumer. In most cases, producers are able to give prompt deliveries of hematite, although the demand is maintained. Not so with Scottish No. 3 foundry iron, however, which is still in very short supply at around 141s. per ton for delivery equal to Manchester.

MIDLANDS.—Stocks of pig-iron at the furnaces are quite substantial in some cases and are being added to steadily. Consumers are well provided for with regard to supplies at the present time, and only a small amount of new business is going through. Pig-iron users in other areas are taking advantage of the conditions ruling in the Midlands and have taken up heavy tonnages from this district. For delivery to Birmingham and Black Country stations, ordinary No. 3 foundry iron is quoted at 111s. per ton for Derbyshire, Lincolnshire and North Staffordshire No. 3, with Northamptonshire No. 3 at 108s. 6d., less 5s. rebate. The machine-tool trade is very active and is taking up heavy tonnages of low-phosphorus iron. The price of this iron varies from £6 7s. 6d. to £7 10s., according to quality and source of supply. Refined iron is at a minimum of £8 10s. per ton. The shortage in the supply of special qualities of hematite persists, but there is little difficulty in procuring adequate tonnages of the ordinary kinds. For delivery to Birmingham and district, East Coast No. 3 is quoted at £7 3s. 6d., with West Coast mixed numbers at £7 4s. 6d. An additional 1s. 6d. per ton is charged if delivery into works is stipulated.

SCOTLAND.—The light-castings section remains quiet, but otherwise industry is working very satisfactorily and the call for supplies of pig-iron is strong. Sufficient tonnages are available in most cases, but this is only as a result of using foreign material, which was contracted for before the rebate scheme was imposed, and local supplies are definitely inadequate to meet the current demand. No. 1 foundry iron is quoted at 120s. 6d., and No. 3 at 118s. f.o.t. furnaces. Small deliveries of Cleveland iron during the past week have relieved the position to some extent. Cleveland iron is quoted at 109s. f.o.t. Falkirk and 112s. f.o.t. Glasgow, less 5s. per ton rebate. Prices of steel-making irons are unchanged, as follow:—Hematite mixed numbers, 133s.; Scottish basic, 107s. 6d.; English and Indian basic, 100s.; all less 5s. per ton rebate.

Coke

Business on the foundry-coke market is not particularly brisk at the moment, as most consumers have booked their requirements over the winter months and are not at all keen to go further ahead than this, although producers would readily do so. Consumers are expecting reduced prices during the summer. For delivery to the Birmingham district, best Durham coke is quoted at 55s. 9d., with Welsh coke at from 55s. to 65s., according to quality.

Steel

Active conditions continue to rule in the steel market, and although production is at a record level, the full output appears to be passing into consumption. In one or two departments, slightly easier conditions have developed and this has given the makers an opportunity of reducing their arrears of deliveries. In most departments of the steel trade, the manufacturers still find it necessary to ration deliveries to consumers on the basis of their requirements in 1936. There has been a considerable improvement in the situation in the semi-finished steel market. Most of the re-rollers are now receiving adequate supplies, partly as a result of the improved home production and partly owing to larger imports of Continental material. Most of the consuming works using this class of steel are now operating at capacity. New business on home account in finished steel has become rather more active, although there is little inclination to enter into far forward commitments. The export demand is somewhat irregular, but lately there has been an increase in the volume of inquiry for several oversea markets.

Scrap

Iron and steel consuming plants continue to call for full contract deliveries. There is a ready demand for any tonnages that come on to the open market and full scheduled prices are being paid. The supply position is definitely easier than it was a few months ago and imports of scrap have been reduced.

Metals

Copper.—There was a surprisingly large increase in world copper stocks during the month of December. According to the American Bureau of Metal Statistics, stocks of refined copper on December 31 totalled 471,750 tons, an increase of 57,900 tons over the total at the end of the previous month. The copper market has been quite strong recently, as the result of substantial buying. Consumers in this country have been fairly active, while Russia and Japan have continued to take up heavy tonnages. In France, despite the political crisis, demand has been on a good scale. No doubt the publication of the rearmament plans in America has been responsible to some extent for the firmer conditions, both in that country and in Europe. The American Smelting & Refining Company, which recently raised its price for domestic copper in small stages to 11 cents per lb., has now reduced its quotation to 10⅜ cents. It is reported that the company sold only a small amount of the metal at the higher price.

Metal Exchange quotations were as follow :—

Cash.—Thursday, £43 8s. 9d. to £43 10s.; Friday, £42 10s. to £42 12s. 6d.; Monday, £43 17s. 6d. to £43 18s. 9d.; Tuesday, £43 5s. to £43 7s. 6d.; Wednesday, £42 6s. 3d. to £42 7s. 6d.

Three Months.—Thursday, £43 11s. 3d. to £43 12s. 6d.; Friday, £42 15s. to £42 16s. 3d.; Monday, £44 to £44 2s. 6d.; Tuesday, £43 10s. to £43 11s. 3d.; Wednesday, £42 11s. 3d. to £42 12s. 6d.

Tin.—This market has continued to be uncertain in tone. While the demand in this country has been satisfactory, there is still rather a poor outlook in the United States. The tinplate trade in this country remains in an unsatisfactory condition, and the works, on the average, are engaged at under 50 per cent. of capacity. The works are badly in need of specifications, and several mills are idle.

Official quotations were as follow :—

Cash.—Thursday, £187 7s. 6d. to £187 10s.; Friday, £185 to £185 10s.; Monday, £188 10s. to £189; Tuesday, £185 10s. to £186; Wednesday, £184 5s. to £184 10s.

Three Months.—Thursday, £187 12s. 6d. to £187 17s. 6d.; Friday, £185 5s. to £185 10s.; Monday, £188 15s. to £189; Tuesday, £186 to £186 5s.; Wednesday, £185 to £185 5s.

Spelter.—Some improvement has been noticeable in this market, but all the ground won has not been held. The weekly market report issued by Rudolf Wolff & Company states that trade demand has shown some expansion, the firmer appearance of the market having attracted rather more interest on the part of consumers, but actual buying in this direction would scarcely account for the rising prices and activity which have taken place, and the firmness must therefore be more particularly attributed to sentiment, the market being influenced by the rise in copper and returning confidence inspired by the more favourable reports in the United States.

Daily market prices :—

Ordinary. — Thursday, £15 10s.; Friday, £15 8s. 9d.; Monday, £15 10s.; Tuesday, £15 7s. 6d.; Wednesday, £15 1s. 3d.

Lead.—Consumers generally have taken up quite heavy tonnages during recent weeks, and the tone of the market has been firm, but during the last few days reaction has been seen. The better reports from New York must be held partly responsible for the brighter outlook recently. The American quotation has been advanced to 4.90 cents. per lb., New York.

Day-to-day quotations :—

Soft Foreign (Prompt).—Thursday, £17 7s. 6d.; Friday, £17; Monday, £16 18s. 9d.; Tuesday, £16 16s. 3d.; Wednesday, £16 1s. 3d.

Scrap.—In most cases, prices of non-ferrous metal scrap have been increased during the past week. Consumers have been in the market for quite good tonnages.

Approximate selling prices for old metal:—New aluminium cuttings, £82; rolled, £66; cast, £40; foil, £88 to £92. Copper, £40 to £44; braziery, £37. Brass (clean), £25 to £28. Zinc, £10 10s. Lead, £16. Gunmetal, £42 to £44.

More Dates and Data

Since we wrote our acknowledgment of diaries and calendars which was published in our Annual Review number last week, we have received from the Stanton Ironworks Company, Limited, near Nottingham, a pocket diary with seven days to the page. This contains a wealth of data about the multitudinous products of the company, as well as those which have been nationally standardised. From Ether, Limited, of Tyburn Road, Erdington, Birmingham, comes a daily tear-off wall calendar carrying a humorous picture of a prehistoric metallurgist undertaking a temperature determination, entitled "Experimentum Crucis."

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SHOT OR SAND BLAST PLANTS
Rooms, Barrels, & Chambers.
WE SHOT AND SAND BLAST FOR ALL TRADES
Established Fifty Years.
R. J. RICHARDSON & SONS, LTD.,
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You can get ANY degree of bond you require green or dry at basic cost with

ALL OVER THE COUNTRY, leading foundries are finding it possible to cut costs by as much as 50% by using "Kordek," the new all-purpose sand binder for cores and facings. "Kordek" is a dry binder which gives the foundryman absolute control over his core sand and makes core production far more economical.

All you have to do is to feed "Kordek" to your mill along with your sand and a small quantity of oil and water.

TEST KORDEK IN YOUR FOUNDRY AT OUR EXPENSE

A trial will cost you nothing and will prove how "Kordek" can cut binder costs in *your* foundry. Mixings and a working sample will be supplied free of charge. One of our technicians is also available for demonstration and advice.

KORDEK

THE ALL-PURPOSE BINDER FOR CORES AND FACINGS

Manufactured by CORN PRODUCTS COMPANY LTD., Bush House, Aldwych, London, W.C.2
BRANCHES: MANCHESTER · BIRMINGHAM · LEEDS · BRISTOL · NEWCASTLE · GLASGOW. FACTORY: MANCHESTER

WARNER Special PIG IRONS

- Warner C.B.R. and Low Carbon Cylinder (FOR CYLINDERS, ROLLS, ENGINEERING CASTINGS, ETC.)
- Low Carbon Malleable (FOR MALLEABLE CASTINGS OF ALL DESCRIPTIONS)

Supplied to any specification between limits of 2·00 and 3·50% Carbon and ·50% and 3·50% Silicon

● ACTUAL ANALYSIS CERTIFICATES ARE AVAILABLE WITH EACH DELIVERY

● **Typical Cylinder Pig Iron Specification**

TOTAL CARBON	2·70%
SILICON	1·80%
MANGANESE	·90%
SULPHUR	·06%
PHOSPHORUS	·40%

● **Typical Malleable Pig Iron Specification**

TOTAL CARBON	2·60%
SILICON	·75%
MANGANESE	·50%
SULPHUR	·05%
PHOSPHORUS	·06%

WARNER & CO., LTD
CARGO FLEET · MIDDLESBROUGH

RAW MATERIALS—PRICE LIST

(Wednesday, January 19, 1938)

COPPER

	£	s.	d.
Standard cash	42	6	3
Three months	42	11	3
Electrolytic	46	10	0
Tough	45	11	3
Best selected	46	1	3
Sheets	78	1	3
India	57	13	9
Wire bars	47	6	3
Ingot bars	47	6	3
H.C. Wire rods	50	16	3
Off. av. cash, Dec.	39	19	8¼
Do., 3 mths., Dec.	40	4	3 5/11
Do., Sttlmnt., Dec.	39	19	6 6/11
Do., Electro, Dec.	44	10	4 1/11
Do., B.S., Dec.	44	8	7⅓
Do., Wire bars, Dec.	45	2	11 5/11
Solid drawn tubes			12¾d.
Brazed tubes			12¾d.
Wire			8½d.

BRASS

Solid drawn tubes	11½d.
Brazed tubes	13½d.
Rods, drawn	9¾d.
Rods, extd. or rlld.	6½d.
Sheets to 10 w.g.	8⅞d.
Wire	8⅝d.
Rolled metal	8⅜d.
Yellow metal rods	6¼d.

TIN

	£	s.	d.
Standard cash	184	5	0
Three months	185	0	0
English	184	5	0
Bars	186	5	0
Straits	187	5	0
Eastern	186	15	0
Banca (nom.)	—		
Off. av. cash, Dec.	190	12	1 5/22
Do., 3 mths., Dec.	189	18	8 7/22
Do., Sttlmt., Dec.	190	11	9 9/11

SPELTER

	£	s.	d.
Ordinary	15	1	3
Remelted	12	5	0
Hard	11	15	0
Electro, 99.9	18	18	9
English	16	12	6
India	15	0	0
Zinc dust	23	10	0
Zinc ashes	6	0	0
Off. aver., Dec.	15	7	0 3/8
Aver., spot, Dec.	15	5	5 11/44

LEAD

	£	s.	d.
Soft foreign, ppt.	16	1	3
Empire (nom.)	17	12	6
English	18	5	0
Off. aver., Dec.	15	15	5 35/44
Aver., spot, Dec.	15	18	11 19/88

ALUMINIUM

Ingots	£100 to £105
Wire	1/3 to 1/4 lb.
Sheet and foil	1/2 to 1/4 lb.

ZINC SHEETS, &c.

Zinc sheets, English	29 0	0 to 29	10 0
Do., V.M. ex-whse.	29 0	0 to 29	10 0
Rods		23	0 0

ANTIMONY

English	81 0	0 to 82	0 0
Chinese, ex-whse.		68	0 0
Crude, c.i.f.		41	0 0

QUICKSILVER

Quicksilver	12	17	3

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—			
25%	12	10	0
45/50%	12	0	0
75%	17	0	0
Ferro-vanadium—			
35/50%	14/- lb. Va.		
Ferro-molybdenum—			
70/75% carbon-free	4/9 lb. Mo.		
Ferro-titanium—			
20/25% carbon-free	9d. lb.		
Ferro-phosphorus, 20/25%	£21 to £22		
Ferro-tungsten—			
80/85%	6/- lb. (nom.)		
Tungsten metal powder—			
98/99%	6/1½ lb. (nom.)		
Ferro-chrome—			
2/4% car.	34	15	0
4/6% car.	24	5	0
6/8% car.	24	0	0
8/10% car.	24	0	0
Ferro-chrome—			
Max. 2% car.	36	0	0
Max. 1% car.	38	5	0
Max. 0.5% car.	41	0	0
70% carbon-free	10d. lb.		
Nickel—99.5/100%	£180 to £185		
"F" nickel shot	£165	0	0
Ferro-cobalt, 98/99%	8/6 to 8/9 lb.		
Metallic chromium—			
96/98%	2/5 lb.		
Ferro-manganese—			
76/80% loose	£18 15	0 to 19	5 0
76/80% packed	£19 15	0 to 20	5 0
76/80% export		£22	0 0
Metallic manganese—			
94/96% carbon-free	1/3 lb.		

Per ton unless otherwise stated, basis 2-ton lots.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	3s. 10d.
Finished bars, 18% tungsten	5s. 0d.

Per lb. d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to ⅜ in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ¼ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

	£	s.	d.	£	s.	d.
South Wales (West)—						
Heavy steel, best	3	8	9 to 3	11	3	
Mixed iron and steel	3	6	9 to 3	9	3	
Heavy cast iron	3	8	9 to 3	11	3	
Good machinery	3	15	0 to 3	17	6	
Cleveland—						
Heavy steel, best	3	7	0 to 3	9	6	
Steel turnings	2	13	0 to 2	15	6	
Heavy cast iron			4	5	0	
Heavy machinery			4	10	0	
Midlands—						
Short heavy steel			4	0	0	
Light cast-iron scrap			3	2	6	
Heavy wrought iron	4	0	0 to 4	5	0	
Steel turnings	2	6	3 to 2	8	9	
Scotland—						
Heavy steel, best	3	5	0 to 3	7	6	
Ordinary cast iron	4	5	0 to 4	7	6	
Cast-iron borings	2	0	6 to 2	3	0	
Wrot-iron piling	4	5	0 to 4	7	6	
Heavy machinery	4	0	0 to 4	2	6	

London—Merchants' buying prices, delivered yard.

Copper (clean)	35	0	0
Brass	24	0	0
Lead (less usual draft)	15	0	0
Tea lead	12	0	0
Zinc	9	0	0
New aluminium cuttings	71	0	0
Braziery copper	32	0	0
Gunmetal	35	0	0
Hollow pewter	135	0	0
Shaded black pewter	97	0	0

PIG-IRON*

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	111/6
,, No. 3	109/-
,, No. 4	108/-
Forge No. 4	108/-
Hematite No. 1	133/-
Hematite M/Nos.	132/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	133/-
,, d/d Birm.	144/6
Malleable iron d/d Birm.	165/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	110/-
,, No. 3 fdry.	111/-
Northants forge	107/6
,, fdry. No. 3	108/6
,, fdry. No. 1	111/6
Derbyshire forge	110/-
,, fdry. No. 3	111/-
,, fdry. No. 1	114/-
Scotland—	
Foundry, No. 1, f.o.t.	120/6
,, No. 3, f.o.t.	118/-
Cleveland No. 3, Glasgow	112/-
,, ,, Falkirk	109/-
Scottish hem. M/Nos. d/d	133/-
Sheffield (d/d district)—	
Derby forge	107/6
,, fdry. No. 3	108/6
Lincs forge	107/6
,, fdry. No. 3	108/6
W.C. hematite	138/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	114/-
Staffs fdry. No. 3	114/-
Northants fdry. No. 3	112/6
Cleveland fdry. No. 3	114/-
Glengarnock, No. 3	141/-
Clyde, No. 3	141/-
Monkland, No. 3	141/-
Summerlee, No. 3	141/-
Eglinton, No. 3	141/-
Gartsherrie, No. 3	141/-
Shotts, No. 3	141/-

(* Prices of hematite and basic pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton under certain conditions.)

FINISHED IRON AND STEEL

Usual district deliveries.

[A rebate of 15/- per ton for steel sections, plates and joists is obtainable in the home trade under certain conditions.]

Iron—	£	s.	d.	£	s.	d.
Bars (cr.)	13	5	0 to 13	15	0	
Nut and bolt iron	11	12	6 to 12	2	6	
Hoops			14	2	6	
Marked bars (Staffs) f.o.t.			15	15	0	
Gas strip			14	2	6	
Bolts and nuts, ¾ in. × 4 in.			17	10	0 and up	
Steel—						
Plates, ship, etc.	11	8	0 to 11	10	6	
Boiler plts.	11	18	0 to 12	0	6	
Chequer plts.			13	0	6	
Angles			11	0	6	
Tees			12	0	6	
Joists			11	0	6	
Rounds and squares, 3 in. to 5½ in.			12	0	6	
Rounds under 3 in. to ⅜ in. (untested)			11	9	0	
Flats—8 in. wide and over			11	5	6	
,, under 8 in. and over 5 in.			11	10	6	
Rails, heavy			10	2	6	
Fishplates			14	2	6	
Hoops (Staffs)			12	4	0	
Black sheets, 24g. (4-t. lots)			15	15	0	
Galv. cor. shts. (,,)			18	10	0	
Galv. flat shts. (,,)			19	0	0	
Galv. fencing wire, 8g. plain			20	5	0	
Billets, soft, 100-ton lots			7	17	6	
Sheet bars			7	15	0	
Tin bars			7	15	0	

PHOSPHOR BRONZE

Per lb. basis

Strip	11½d.
Sheet to 10 w.g.	11⅜d.
Wire	13½d.
Rods	13¾d.
Tubes	18¾d.
Castings	15½d.

Delivery 3 cwt. free.
10% phos. cop. £33 above B.S.
15% phos. cop. £38 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

Per lb.

Ingots for raising	8d. to 1/2
Rolled—	
To 9 in. wide	1/2 to 1/8
To 12 in. wide	1/2½ to 1/8½
To 15 in. wide	1/2½ to 1/8½
To 18 in. wide	1/3 to 1/9
To 21 in. wide	1/3½ to 1/9½
To 25 in. wide	1/4 to 1/10
Ingots for spoons and forks	8d. to 1/4½
Ingots rolled to spoon size	11d. to 1/7½
Wire round—	
to 10g.	1/5½ to 2/0½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/4½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	25.76
No. 2 foundry, Valley	24.00
No. 2 foundry, Birm.	20.38
Basic, Valley	23.50
Malleable, Valley	24.00
Grey forge, Valley	23.50
Ferro-mang. 80%, seaboard	102.50
O.-h. rails, h'y, at mill	42.50
Billets	37.00
Sheet bars	37.00
Wire rods	47.00
	Cents.
Iron bars, Chicago	2.40
Steel bars	2.45
Tank plates	2.25
Beams, etc.	2.25
Skelp, grooved steel	2.10
Steel hoops	2.40
Sheets, black, No. 24	3.15
Sheets, galv., No. 24	3.80
Wire nails	2.75
Plain wire	2.90
Barbed wire, galv.	3.40
Tinplates, 100-lb. box	$5.35

COKE (at ovens)

Welsh foundry	42/6
,, furnace	37/6
Durham foundry	39/6
,, furnace	32/6 to 37/6
Scottish foundry	42/6
,, furnace	40/-

TINPLATES

f.o.b. British Channel ports.

I.C. cokes	20×14 per box	22/6 to 23/6
,,	28×20 ,,	45/- to 47/-
,,	20×10 ,,	34/9 to 35/3
,,	18¾×14 ,,	24/9 to 25/3
C.W.	20×14 ,,	18/6 to 19/-
,,	28×20 ,,	37/- to 38/-
,,	20×10 ,,	30/- to 30/6
,,	18¾×14 ,,	21/3 to 21/6

SWEDISH CHARCOAL IRON & STEEL

Pig-iron	£12	0	0 to £13	0	0	
Bars-hammered, basis	£20	0	0 to £22	0	0	
Bars and nail-rods, rolled, basis	£19	0	0 to £20	0	0	
Blooms	£18	0	0 to £19	0	0	
Keg steel	£30	0	0 to £35	0	0	
Faggot steel	£20	0	0 to £25	0	0	
Bars and rods dead soft st'l	£19	0	0 to £20	0	0	

All per English ton, f.o.b. Gothenburg [Subject to an exchange basis of Kr 19.39 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

		£ s. d.	
Jan.	13 ..	43 8 9	dec. 13/9
,,	14 ..	42 10 0	,, 18/9
,,	17 ..	43 17 6	inc. 27/6
,,	18 ..	43 5 0	dec. 12/6
,,	19 ..	42 6 3	,, 18/9

Electrolytic Copper

		£ s. d.	
Jan.	13 ..	47 10 0	dec. 17/6
,,	14 ..	46 5 0	,, 25/-
,,	17 ..	47 15 0	inc. 30/-
,,	18 ..	47 10 0	dec. 5/-
,,	19 ..	46 10 0	,, 20/-

Standard Tin (cash)

		£ s. d.	
Jan.	13 ..	187 7 6	dec. 72/6
,,	14 ..	185 0 0	,, 47/6
,,	17 ..	188 10 0	inc. 70/-
,,	18 ..	185 10 0	dec. 60/-
,,	19 ..	184 5 0	,, 25/-

Tin (English ingots)

		£ s. d.	
Jan.	13 ..	187 7 6	dec. 72/6
,,	14 ..	185 0 0	,, 47.6
,,	17 ..	188 10 0	inc. 70/-
,,	18 ..	185 10 0	dec. 60/-
,,	19 ..	184 5 0	,, 25/-

Spelter (ordinary)

		£ s. d.	
Jan.	13 ..	15 10 0	dec. 7/6
,,	14 ..	15 8 9	,, 1/3
,,	17 ..	15 10 0	inc. 1/3
,,	18 ..	15 7 6	dec. 2/6
,,	19 ..	15 1 3	,, 6/3

Spelter (Electro, 99.9 per cent.)

		£ s. d.	
Jan.	13 ..	19 6 3	dec. 8/9
,,	14 ..	19 5 0	,, 1/3
,,	17 ..	19 5 0	No change
,,	18 ..	19 5 0	,, ,,
,,	19 ..	18 18 9	dec. 6/3

Lead (soft foreign, prompt)

		£ s. d.	
Jan.	13 ..	17 7 6	dec. 3/9
,,	14 ..	17 0 0	,, 7/6
,,	17 ..	16 18 9	,, 1/3
,,	18 ..	16 16 3	,, 2/6
,,	19 ..	16 1 3	,, 15/-

Lead (English)

		£ s. d.	
Jan.	13 ..	19 10 0	No change
,,	14 ..	19 0 0	dec. 10/-
,,	17 ..	19 0 0	No change
,,	18 ..	18 15 0	dec. 5/-
,,	19 ..	18 5 0	,, 10/-

Imports and Exports of Pig-iron, Castings, etc., in December and the Twelve Months 1937, compared with December and the Twelve Months 1936

	December.		Twelve months.		December.		Twelve months.	
	1936.	1937.	1936.	1937.	1936.	1937.	1936.	1937.
	Tons.	Tons.	Tons.	Tons.	£	£	£	£
Imports.								
Pig-iron—from British India	20,366	26,680	144,414	214,985	66,896	132,875	463,859	934,643
,, ,, Other British Countries	—	—	—	34,973	—	—	—	187,466
,, ,, Foreign Countries	2,493	45,528	102,849	394,729	14,978	255,017	363,708	2,405,564
Total	22,859	72,208	247,263	644,687	81,874	387,892	827,567	3,527,673
Castings and forgings	330	581	6,241	3,690	11,740	20,826	216,378	117,462
Cast pipes and fittings	299	104	1,670	2,038	7,184	3,818	55,896	51,876
Stoves, grates, etc.	68	43	899	912	8,116	3,702	77,117	84,761
Baths	940	459	8,501	8,381	21,364	12,050	203,830	208,809
Hollow-ware, all kinds	420	351	3,983	4,047	20,852	23,136	202,792	250,929
Exports.								
Pig-iron, forge and foundry	5,477	3,818	57,484	87,016	23,317	26,818	224,014	480,867
,, acid	4,010	5,235	41,927	65,951	15,901	38,355	155,257	385,889
,, basic	5	—	207	573	25	6	1,034	3,576
Total	9,492	9,053	99,618	153,540	39,243	65,179	380,305	870,332
Castings and forgings	361	145	4,025	2,817	12,843	6,713	150,911	110,328
Cast pipes and fittings, up to 6 in. diameter	5,145	5,296	57,938	60,800	55,574	65,438	640,103	698,359
,, ,, ,, over 6 in. ,,	2,785	3,499	38,718	47,821	23,019	35,283	318,033	400,779
Stoves, grates, etc.	999	953	10,664	10,927	53,322	51,626	539,333	587,396
Sanitary cisterns	317	343	3,045	3,650	9,842	13,441	95,166	126,518
Bedsteads, including tubes therefor	472	250	5,030	5,540	16,075	13,005	182,989	224,763
Hollow-ware	524	530	5,641	5,321	18,409	18,356	202,040	192,517

WILLIAM JACKS & COMPANY,
WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.
CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.
13, RUMFORD STREET, LIVERPOOL.
PIG IRON
REGISTERED TRADE MARK LIMPET
FOR EVERY TYPE OF CASTING
NON-FERROUS METALS
REFRACTORIES — COKE — SAND
FERRO-SILICON—FERRO-CHROME
WILLIAM JACKS & COMPANY,
CENTRAL CHAMBERS, 93, HOPE ST., GLASGOW, C.2.
ZETLAND ROAD, MIDDLESBROUGH.

Notice

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-

(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED

CUPOLA MAN desires situation. Knows job thoroughly. Will furnish fullest particulars. Two references.—Box 754, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY FOREMAN desires change. Age 35, wide practical experience oil engine, machine tool, chemical plant, etc. Sound technical training. Non-ferrous experience. Progressive yet tactful. Good record. Seeks opportunity.—Box 764, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

GENERAL MANAGER, 38, qualified foundryman, engineer, and accountant, A.M.I.Mech.E., A.I.I.A., etc.; excellent record of successful business development and works administration; expert in foundry costs and the mechanisation of "mixed" production. Seeks wider scope or offers services as Consultant. Minimum remuneration £1,500 a year.—Box 758, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

PATTERNMAKER seeks change as Foreman. General engineering, loam and strikle, jigs and moulds. Practical foundry and drawing office experience. Technical qualifications.—Apply Box 756, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

PROGRESSIVE Foundry Manager, age 40, at present engaged in foundry taking in all types of general engineering castings, mechanised plant, iron and non-ferrous, patternshop, etc. Fully capable of taking entire charge and guarantee results. Go anywhere.—Box 740, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

CHARGEHAND for small steel foundry wanted. Must be live wire and able to get work out. State age, experience, and wage required.—Box 760, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOREMAN PATTERNMAKER required by large ironworks in India. Applicants should be about 30 years of age, preferably single, and must be conversant with modern foundry practice in green, dry and loam moulding, and be competent to control and organise labour and compute material and labour rates. Salary according to qualifications, free passages, provident fund. Apply, by letter, stating age and whether married or single, giving copies of testimonials, to: "CORE BOX," c/o ABBOTTS, Eastcheap, London, E.C.3.

FOUNDRY FOREMAN required for small iron foundry. One with experience of casting baths for enamelling preferred. Apply giving full particulars of age, experience, and wage required to: Box 748, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY SUPERINTENDENT required by J. & E. Hall, Ltd., Dartford, to take charge of cast iron and non-ferrous foundries. Preference will be given to applicants with metallurgical experience. Write to Staff Manager, giving full particulars of experience, age, and salary required, which will be treated as confidential.

SITUATIONS VACANT AND WANTED—*Contd.*

REPRESENTATIVE required by firm manufacturing well-known foundry specialities for Lancashire and Yorkshire. State age and previous experience.—Box 750, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

WANTED.—Representatives calling upon non-ferrous foundries for sale of a product manufactured by large company not at present connected with foundry industry. Please give full particulars of area covered, etc., to: MESSRS. C. L. BENCARD (1934), LTD., Hendon, London, N.W.4.

WANTED.—First-class Foundry Manager, able to take complete charge of the layout of a new large mechanised steel and iron foundry; and afterwards of the production of steel and iron castings. Good prospects of directorship for the right man.—Box 752, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

MACHINERY

BEST OFFERS WANTED for 500 tons BROKEN MACHINERY C.I. SCRAP, up to 1-cwt. pieces. Cash; early delivery f.o.r. London.—Box 762, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

NEW Dwarf Cupola, to melt 10 to 15 cwts. per hr. New Worm-geared Ladles, 5 tons, 25 cwts., 15 cwts. and 10 cwts. capacity. Ungeared Ladles, 15 cwts. and 10 cwts. capacity. Improved Cupola Spark Arresters.—T. DAVIES & SON, West Gorton, Manchester.

ELECTRIC CUPOLA BLOWERS (large stock), including two 50-h.p. 3/50/400 volts, 2,900 r.p.m.; Keith Blackman; 12-in. outlet.
30-h.p. ditto; 12-in. outlet.
5-h.p. ditto; 6-in. outlet.
20-h.p. 460 volts d.c., 2,400/1,900 r.p.m.; 10-in. outlet.
EXHAUST FANS (large stock), electrical and belt driven.
ELECTRIC RUNWAY LIFTING BLOCKS:
One 4½-ton 460 volts d.c., Vaughan.
Two 2-ton ditto, Morris.
One ½-ton 220 volts d.c., Morris (as new).
One ½-ton 3/50/440 volts, Aabacus.
Two Reavell Rotary Compressors, 12 lbs sq. in. pressure; 750 cub. ft. direct-coupled on bedplate to 60 h.p. S.R., 3/50/400 volts motor
½-cwt. Pilkington Self-contained Pneumatic Hammer.
Geared Foundry Ladles, 9, 4, 3½, 2½ and 1 ton, etc.
AIR COMPRESSORS: 30 in stock in sizes 500 to 20 cub. ft.
ELECTRIC MOTORS: Large stock to suit almost all electric systems.
S. C. BILSBY, A.M.I.C.E., A.M.I.E.E.
CROSSWELLS ROAD (Adjoining Railway Crossing), LANGLEY, Nr. Birmingham.
'Phone: Broadwell 1359.

THOS. W. WARD LTD.

LANCS. BOILER; 30′ x 8′; 150 lbs. w.p.
LANCS. BOILER; 30′ x 8′ 6″; 150 lbs. w.p.
75-h.p. "Holt" TRACTOR.
New O.T. Self-colour CISTERNS; 4′ x 4′ x 4′; 400 galls.

Write for "Albion" Catalogue.

'Grams: "Forward." 'Phone: 23001 (10 lines).

ALBION WORKS, SHEFFIELD.

MACHINERY—*Continued*

WANTED.—Stationary Sandslinger Machine, complete with motors suitable 3-ph., 50 p., 400 v. Detailed description and price to: Box 744, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

½-TON MORGAN oil-fired C.A. type Tilter: 600-lb. Ditto, as new, without burners. Cheap. Also a number of NEW Crucibles, 300 lbs. and 600 lbs. capacity.—A. HAMMOND, 14, Australia Road, Slough.

SAND MIXERS AND AERATORS.—The "Breakir" Centrifugal Machine is *THE* machine. Outputs 10 cwts. to 8 tons per hr.—W. BREALEY & Co., LTD., Station Works, Ecclesfield, Sheffield.

WANTED.—Hand Moulding Machines, must be in sound condition; also Moulding Boxes, interchangeable. Full particulars and prices to: COOKE BROS., Ironfounders, Leicester.

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